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EDITED BY

COLONEL SIR WILLIAM H. HORROCKS, K.C.M.G., C.B.

ASSISTED BY

LIEUT.-COLONEL D. HARVEY, C.M.G., R.A.M.C.

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Original Communications.

TOXIC ACTION OF CARBONIC AND OTHER WEAK ACIDS ON THE MENINGOCOCCUS.

BY J. A. SHAW-MACKENZIE, M.D.LOND.

IN attempting to discover an effective method of direct antiseptic treatment of cerebrospinal meningitis, it would seem advisable, when one considers the delicate nature and fundamental physiological importance of the nervous structures involved, to employ, as the basis of the antiseptic fluid in view, a solution as uninjurious as possible to mammalian living tissues. Ringer showed long ago that the tissues of cold-blooded animals are capable of long survival, if instead of perfusing or bathing them with 0·6 per cent NaCl solution, regarded up till then as the physiological solution *par excellence*, a solution containing in addition to the sodium chloride, physiological amounts of calcium and potassium salts and a trace of sodium bicarbonate were employed. Many years afterwards Locke [1] succeeded in extending this line of work to mammalian tissues, and showed that a Ringer's solution of modified composition and containing in addition sufficient oxygen and a physiological percentage of glucose was capable of sustaining the activity of the excised mammalian heart for long periods. The power of conserving the vital activities of the mammalian tissues in contact with the Ringer-Locke fluid has since been abundantly confirmed by various workers in the case of many different organs. It has been pointed out, too, by Professor Halliburton [2] that the cerebrospinal fluid itself is in its composition to all intents and purposes nothing but a Ringer-Locke fluid of physiological origin. We have, therefore, abundant grounds for taking as the basis of any antiseptic solution with which it is proposed to treat the nervous system the Ringer-Locke fluid, in the hope that at any rate this will have no special deleterious effect of its own, and that we shall have only to fear such from the antiseptic agent we add to it. It

will be better too, if in all probability, instead of an antiseptic foreign to the body, we can find a physiological antiseptic agent, produced by an exaggeration or diminution of the physiological factors involved. From this general point of view the work described in the following has been undertaken.

I was led to this inquiry by my previous work on the toxic action of copper compounds of amino-acids and in particular copper-alanine on protozoa [3]. For, in the early part of last year, in some preliminary experiments, the opportunity for which was kindly afforded me by Professor R. T. Hewlett in the Bacteriological Laboratory, King's College, a toxic action of copper-alanine (one part in 100,000 of water) was found on the meningococcus also, on thirty minutes' exposure.

In further experiments carried out in association with Lieutenant-Colonel Mervyn Gordon and Major Hine, at the Central Cerebrospinal Laboratory, Royal Army Medical College, it was shown that the meningococcus did not survive in concentrations of copper-alanine 1 in 1,000 in sodium chloride solution, on twenty minutes' exposure, but in less concentration or in broth or serum, no toxic effect was observed in this time limit. Experiments were also made with the copper-alanine in Ringer-Locke solution. A somewhat more toxic effect was witnessed, as in this case the meningococcus did not survive in 1 in 10,000 copper-alanine on twenty minutes' exposure. No toxic effect was observed on five or ten minutes' exposure, and as for purposes of local treatment, intrathecal or naso-pharyngeal, a short time limit is obviously essential, the above results did not indicate any special advantage in the employment of copper-alanine as a bactericide in the treatment of cerebrospinal meningitis. Nor could the solutions of 1 in 10,000 in Ringer-Locke fluid be regarded as suitable for intrathecal use without fear of injury to the delicate tissues of the central nervous system.

In these experiments, however, it was noticed that in two out of three controls in 0·85 per cent sodium chloride solution alone, the meningococcus survived. On the other hand, the meningococcus had not survived in all three controls in Ringer-Locke solution alone. In all these cases the control solutions had been inoculated at the commencement of the series, and planted out in the usual way at the end—in each case the exposure having been forty-five minutes at 37° C.

This unexpected observation in the case of Ringer-Locke solution opened up therefore a further line of inquiry. For, if it held good that Locke's modification of Ringer's fluid, corresponding in its salt constituents to the natural fluids of the body, possessed in addition bactericidal properties towards meningococcus, obviously the value of this solution for irrigation purposes and intrathecal use would be still further evident.

Investigation has therefore been carried out by me in this direction in the Bacteriological Laboratory, King's College, with the assistance of Mr. F. Welch.

TECHNIQUE.

The composition of the Ringer-Locke solution used was NaCl, 0·9 per cent; KCl, 0·042 per cent; $CaCl_2$ (anhydrous), 0·024 per cent; dextrose, 0·1 per cent; $NaHCO_3$, 0·02 per cent. The water employed was distilled in glass. The $NaHCO_3$ is added last to the remaining constituents after their previous sterilization. The $NaHCO_3$ itself cannot be heated to ensure sterilization, but in these experiments practically this has proved negligible. Five cubic centimetres of distilled water was added to a twenty-four-hour culture on trypagar slope of an isolated strain of meningococcus (Foster II) used throughout, forming a milky suspension (approximately 5,000 million meningococci to one cubic centimetre). Of this, in earlier experiments, 0·1 cubic centimetre was added to 10 cubic centimetres of the respective test solutions in sterile test tubes, and also to the same amounts of water, 0·85 to 0·9 per cent sodium chloride solution, and of trypsin broth; these latter were for control purposes; in subsequent experiments, in order to ensure greater uniformity in results, 0·2 cubic centimetre of the meningococcal suspension was taken as the inoculating dose. After five, twenty, and sixty minutes' exposure of the meningococcus in suspension to the various solutions kept at 37° C., the test tubes were well shaken and a three-millimetre loopful of each solution was planted out on trypagar slopes. These were then incubated at 37° C., and the results read off in twenty-four and forty-eight hours. The forty-eight hours' incubation is necessary as in many instances the twenty-four hours' incubation proved insufficient, and the result, therefore, at that period is unreliable. Either the subcultures of meningococcus showed growth or not, and the result was charted as + or —; even single colonies were marked +.

THE BEHAVIOUR OF THE MENINGOCOCCUS IN RINGER-LOCKE SOLUTION, AND THE ACTION OF ITS INDIVIDUAL CONSTITUENTS.

At first, using 0·1 cubic centimetre of meningococcal suspension as the inoculating dose, as previously employed, two out of three separate experiments showed that the meningococcus did not survive on sixty minutes' exposure to Ringer-Locke solution, thus appearing to confirm the original results. Controls in water and in 0·85 and 0·9 per cent sodium chloride solution survived. The action therefore of the individual constituents of Ringer and of Ringer-Locke solutions was investigated.

Water.—In water distilled in glass, as well as in ordinary distilled water and in tap water, the meningococcus was shown to survive on five, twenty, and sixty minutes' exposure.

Pure Sodium Chloride 0·85 and 0·9 per cent solutions. The survival of the meningococcus in these solutions has almost invariably been evident on five, twenty and sixty minutes' exposure at 37° C. and planting out, with incubation for twenty-four and forty-eight hours at 37° C. Since the

completion of my experiments my attention has been directed to the work of Flexner [4] and of Shearer [5], both of whom conclude that physiological solutions of sodium chloride have a destructive or toxic action on the meningococcus. The discrepancy between their and my results may be explained in part by the different conditions of experiment. In my experiments, I have confined myself to a short time limit of exposure, whereas Flexner's results apparently refer to comparatively long periods of exposure, and Shearer's to an exposure of seventy-five minutes. In a few experiments which I have since made, survival of the meningococcus has been evident on exposures for two hours, followed by forty-eight hours' incubation. Shearer notes, however, that freshly isolated meningococci are more vulnerable to the action of sodium chloride than old laboratory cultures; the former seldom resist the action of 0·85 per cent pure sodium chloride for more than twenty minutes, though the latter could sometimes resist the action for three to four hours. It may be that a difference in results is due to the salt itself employed. Throughout my experiments I was using "pure sodium chloride," but quite recently coming towards the end of this particular stock bottle, I started on another. The meningococcal controls in this sodium chloride solution did not survive as usual (and the results in several sets of experiments, in consequence, were discarded as valueless). The experiments had been carried out precisely in the same way as before except in the alteration of the salt employed. On reverting to the first stock bottle, the meningococcus again survived. Both specimens of the sodium chloride were Kahlbaum's "guaranteed pure for analysis."[1]

Calcium Chloride, Potassium Chloride, and Dextrose respectively in 0·85 and 0·9 per cent sodium chloride solution have each been favourable to the survival of the meningococcus in my experiments.

Sodium Bicarbonate.—Repeated experiments showed that the meningococcus did not survive on sixty minutes' exposure to sodium bicarbonate 0·02 to 0·04 per cent in sodium chloride solution. From this it was inferred that the injurious effects on the meningococcus in Ringer-Locke solution were due to the sodium bicarbonate. Repetition, however, of my previous experiments with Ringer-Locke solution, using 0·1 cubic centimetre of the suspension as the inoculating dose, failed to confirm the earlier results, and no difference was observed in the Ringer-Locke solution with or without the sodium bicarbonate. It is difficult to explain these contradictory results. It may, however, be mentioned that the Ringer-Locke solution employed in the earlier experiments was stock solution in

[1] Dr. Locke informs me that a similar variation in the behaviour of "chemically pure" sodium chloride from different sources in physiological solutions, was observed by him in conjunction with Dr. Rosenheim in 1903. Certain specimens give solutions which fail to keep the mammalian heart alive beyond two or three hours, and prevent it showing any improvement with dextrose.

which a commercial sodium chloride had been used which is no longer obtainable. It is possible this was of a toxic nature. It became of interest to ascertain the effect of increasing the percentage amount of sodium bicarbonate; but with one per cent and two per cent in Ringer-Locke solution, the meningococcus continued to survive. Not only this, but when sodium chloride solution was used, the addition of one per cent sodium bicarbonate exerted no greater effect than that of 0·02 per cent had done, while even in the two per cent solution the meningococcus survived. Repetition of the experiment on several occasions confirmed this, at first sight, paradoxical result. That increased percentages of $NaHCO_3$ had less toxic effect could hardly be explained on the supposition that it acted by virtue of its alkalinity or the relative concentration of the hydroxyl ions. Considering the well-known facts so important for the theory of respiration, of the dissociation of $NaHCO_3$ in solution into Na_2CO_3 and CO_2, it seemed not impossible that in dilute solutions with more complete dissociation of the salt, the free CO_2, especially in the case of micro-organisms, might be the active factor, and it became worth while to investigate the action in physiological solution of CO_2 and other weak acids on the meningococcus. In order to get rapidly a definite idea of the effect of weak acids, experiments were made first with acetic acid.

Action of Acids.

Acetic Acid.—After exposure of the meningococcus 0·2 cubic centimetre suspension to ten cubic centimetres solutions of acetic acid of strength respectively one per cent, 1 in 1,000, and 1 in 10,000 in 0·9 per cent sodium chloride solution, a toxic effect was definitely shown. The meningococcus survived only on five minutes' exposure in the 1 in 10,000 solution. Controls in sodium chloride solution and in water survived as usual on the sixty minutes' exposure. Further experiments were made with M/2500 acetic acid in 0·9 per cent sodium chloride solution (corresponding roughly to 1 in 50,000). Survival of the meningococcus was noted only on the five minutes' exposure; longer than this proved fatal.

Carbonic Acid.—Greater interest would seem to attach to the investigation of the effect of carbonic acid on the meningococcus. This is the weakest physiological acid. It is constantly present in greater or less amount in the blood and other body fluids. Its effects on living tissues when not pushed to their limit are reversible. A concentration too great to be borne by the central nervous system when perfused through its blood-vessels would probably be successfully resisted if the solution was introduced intrathecally, the persistence of the normal blood current in the central nervous system ensuring its survival.

Solutions of free carbonic acid were obtained by passing the washed gas from a Kipp apparatus through the fluid used, for periods varying from

one to two minutes, some approximation to saturation being thus obtained. In order, however, to obtain solutions containing known percentages of free carbonic acid, the method employed was one suggested to me by Dr. F. S. Locke which he had already made use of in order to prepare perfusion fluids for the mammalian heart, of known free CO_2 content. It possesses also the advantage of giving a solution that can be sterilized by boiling. The method depends on the conversion of sodium carbonate by sulphuric acid into sodium sulphate, sodium bicarbonate and (in accordance with the relative amounts of Na_2CO_3 and H_2SO_4) the percentage of CO_2 required. Thus:—

$$2\,Na_2CO_3 + H_2SO_4 = 2\,NaHCO_3 + Na_2SO_4$$
$$Na_2CO_3 + H_2SO_4 = CO_2 + Na_2SO_4 + H_2O$$

It is obvious, therefore, that by the mixture of suitable amounts of equivalent solutions of Na_2CO_3 and H_2SO_4 we can readily obtain within wide limits the required percentages of $NaHCO_3$ and CO_2. The Na_2SO_4 formed is for our purposes negligible. Ideal quantitative accuracy is not required in the use of this method, as the small percentage of $NaHCO_3$ always left in the final solutions acts as a "buffer" preventing the presence of free H_2SO_4.

It was found convenient to use ¼ normal solutions for the additions necessary for the formation of the small amount of $NaHCO_3$ used. For the further equal amounts of H_2SO_4 and of Na_2CO_3 forming the required percentage of CO_2, ½ normal solutions were made use of. The following solutions were investigated:—

Solution No.	Ringer-Locke (without alkali or dextrose)	$N/4H_2SO_4$	$N/4Na_2CO_3$	$N/2H_2SO_4$	$N/2Na_2CO_3$	Volume per cent CO_2
	c.c.	c.c.	c.c.	c.c.	c.c.	
1	50	0·25	0·5	1	1	11
2	50	0·25	0·5	2	2	22
3	50	0·25	0·5	4	4	44

The necessary amounts of H_2SO_4 can be added to the non-alkaline Ringer-Locke fluid, and the mixture sterilized. The Na_2CO_3 solutions can be separately sterilized, and added in the cold to the H_2SO_4 mixture. Toxic effects on the meningococcus were found with Solutions 2 and 3, but not with Solution 1.

Similar solutions were investigated also in which fifty cubic centimetres sodium chloride solution were used in place of the Ringer-Locke solution. With these a toxic effect was found with Solution 1.

The results, together with toxic effects obtained at the same time with sterilized solutions of 0·9 per cent sodium chloride through which the CO_2 gas itself had been passed,[1] are given in the following tables of two experiments.

[1] (The supposed saturation with CO_2 thus obtained may be assumed to have been anything between sixty to eighty volumes per cent).

A third experiment was made with similar results: 0·2 cubic centimetre meningococcal suspension was taken as usual, as the inoculating dose to 10 cubic centimetres of each solution; results with Ringer-Locke solution (0·02 per cent $NaHCO_3$) and with $NaHCO_3$ (0·02 per cent) in sodium chloride solution, obtained at the same time and under the same conditions of experiment are given also, and in these 0·1 cubic centimetre suspension was taken as the inoculating dose as in the earlier experiments.

(1)	Forty-eight hours' incubation at 37° C.		
Exposure in minutes at 37° C.	5	20	60
Ringer-Locke solution CO_2 (Solution 1)	+	+	+
,, ,, ,, (Solution 2)	+	+	−
,, ,, ,, (Solution 3)	+	−	−
NaCl 0·9 per cent solution CO_2 (Solution 1)	+	−	−
CO_2 gas in 0·9 per cent NaCl solution	+	−	−
NaCl 0·9 per cent solution alone	+	+	+
Water (glass, distilled)	+	+	+
Broth	+	+	+
Meningococcal suspension at room temperature	..	..	+
Subculture +			

(2)	Forty-eight hours' incubation at 37° C.		
Exposure in minutes at 37° C.	5	20	60
Ringer-Locke solution CO_2 (Solution 2)	+	+	−
,, ,, (Solution 3)	−	−	−
NaCl 0·9 per cent solution CO_2 (Solution 1)	+	+	−
CO_2 gas in 0·9 per cent NaCl solution	+	−	−
Ringer-Locke solution (0·02 per cent $NaHCO_3$)	+	+	+
$NaHCO_3$ (0·02 per cent) in 0·9 per cent NaCl solution	+	+	−
NaCl 0·9 per cent solution alone	+	+	+
Water (glass, distilled)	+	+	+
Broth	+	+	+
Meningococcal suspension at room temperature	..	..	+
Subculture +			

It will be seen from the above that Ringer-Locke CO_2 solution, sodium chloride CO_2 solution, and sodium chloride solution, through which CO_2 gas has been passed, respectively, exert a definite toxic effect on the meningococcus. On the other hand, it will be seen that the meningococcus survived in Ringer-Locke solution (0·02 per cent $NaHCO_3$), but did not survive exposure of sixty minutes to $NaHCO_3$ (0·02 per cent) in sodium chloride solution. Controls in sodium chloride solution alone, water, and in broth, survived as usual.

Serum.—A destructive action by serum (guinea-pig) on meningococcus has been shown by Flexner. In the following preliminary experiment a rapid or increased toxic effect of serum through which CO_2 has been passed is shown. For this purpose fresh sterile serum (rabbit) was used. The serum was slightly blood-stained; 2·5 cubic centimetres of the serum so treated and 2·5 cubic centimetres of the normal serum were inoculated with 0·05 cubic centimetre of meningococcal suspension; the technique being otherwise the same as described in previous experiments. A toxic action

of the serum (rabbit) control is not evident under the conditions of a short time limit of exposure in my experiment. The effect of CO_2 gas in sodium chloride solution was again examined (0·2 cubic centimetre suspension to ten cubic centimetres solution), and the toxic action confirmed.

	Forty-eight hours' incubation at 37° C.		
Exposure in minutes at 37° C	5	20	60
Serum CO_2 gas	+	–	–
Serum alone	+	+	+
CO_2 gas in 0·9 per cent NaCl solution	+	–	–
NaCl 0·9 per cent solution alone	+	+	+
Water (glass, distilled)	+	+	+
Meningococcal suspension at room temperature	..	..	+
Subculture +			

Lactic Acid.—Next to carbonic the most important acid katabolite is lactic acid. It is produced by many organisms, and it seemed of interest to investigate its effect on the meningococcus which is known to ferment dextrose. Sarcolactic acid has not so far been investigated. The pharmacopœial lactic acid was made use of. In M/2500 and M/5000 (in 0·9 per cent sodium chloride solution) it was found to exert a marked toxic effect, showing survival of the meningococcus only on the five minutes' exposure.

On the suggestion of Dr. O. Rosenheim, an attempt has been made by me to investigate the relationship which might exist between the toxic effect of the above acid solutions and their hydrogen ion concentration. A hydrogen ion concentration of PH 7·02 represents absolute neutrality, and PH 7·35 near that of the blood [6]; which reaction for cultural purposes on nutrient media is also near the optimum for the growth of most pathogenic organisms [7]. The hydrogen ion concentration of cerebrospinal fluid (man) has been represented as PH 8·1 when fresh, but, on standing, it soon reaches PH 9·25, attributed to the loss of carbonic acid [8]. According to Hurwitz and Tranter [9] the PH varies from 8·15 to 8·3, and cerebrospinal fluid is thus regarded by them as more alkaline than blood. Milroy [10] has recently confirmed this, and points out further that the PH at low CO_2 pressure is higher, or, in other words, the alkalinity is greater than blood plasma.

For the above-mentioned purpose a series of Sörensen's standard mixtures of primary potassium phosphate and secondary sodium phosphate were prepared. It was found that in a mixture of 9·75 cubic centimetres M/15 primary phosphate and 0·25 cubic centimetre M/15 secondary phosphate, corresponding to a hydrogen ion concentration of PH 5·3, the meningococcus did not survive on sixty minutes' exposure. In primary phosphate solution alone, corresponding to a hydrogen ion concentration of PH 4·5, the meningococcus failed to survive on twenty minutes' exposure. I append a typical experiment, the technique employed being the same as before.

Phosphate mixture		Methyl red 5 drops, 10 c.c. colouration (before inoculation)	PH	Toxic action—minutes		
Primary c.c.	Secondary c.c.			5	20	60
3·0	7·0	Yellow ..	7·2	+	+	+
7·0	3·0	" ..	6·4	+	+	+
9·75	0·25	Faint pink ..	5·3	+	+	–
10·0	0·0	Pink.. ..	4·5	+	–	–

The toxic lactic and acetic acid solutions gave similar reactions, the PH in these cases ranging also between 4·5 and 5·3. The toxic concentration of CO_2 in Ringer-Locke solution gave the same result. The much weaker concentration of CO_2 (11 vols. per cent) (Solution 1) however, which had been found toxic to the meningococcus in pure sodium chloride solution, gave only a yellow colouration with the indicator indistinguishable from that given by pure sodium chloride solution alone. In pure sodium chloride solution therefore a much weaker hydrogen ion concentration due to CO_2 is toxic to meningococcus than corresponds to PH 4·5 to 5·3. The indicators at my disposal did not permit of a more exact result than this. It is, moreover, obvious that the hydrogen ion concentration of the standard and other solutions is considerably lowered by the added meningococcal suspension which by itself possesses a distinct alkaline reaction. Further experiments in which the micro-organism itself is exposed directly to the solutions, or cultured in nutrient media of known PH, will be necessary to determine the point at which a toxic action is exerted. It will be necessary also to ascertain the hydrogen ion concentration of the cerebrospinal fluid itself in cerebrospinal meningitis.

In interpreting the results obtained with CO_2 regard must not be lost of the fact that CO_2 as an acid occupies quite a special physiological position as a general end product of vital chemical reactions. Increased percentages of it, therefore, in physiological fluids might exert a specific inhibitory effect on the vital activity of micro-organisms also, in addition to its effect as an acid in increasing hydrogen ion concentration.

It would appear from the results of the investigation described above, that local treatment of areas, intrathecal and naso-pharyngeal, infected with meningococcus might be tried with Ringer-Locke fluid, or with sodium chloride solutions, containing, as physiological antiseptics, physiologically excessive amounts of carbonic or lactic acids.

Slater [11], Rideal [12], and others have described the bactericidal action of CO_2 in solution on various pathogenic bacteria; these, however, differ considerably in their resistance to CO_2. The local application of the gas itself has also been described with sedative and beneficial effects in the treatment of open wounds and ulcerations, as well as by rectal introduction in cases of dysentery.

In extending this investigation I have found, in preliminary experi-

ments, that carbonic acid in sodium chloride solution exerts a rapid toxic effect on the protozoon opalina; also on *Spirochæta pallida.* The possible use of carbonic acid in syphilitic disease of the central nervous system, and in the treatment of diseases due to protozoa, is thus suggested.

In conclusion, I desire to express my best thanks to Professor Halliburton and to Professor Hewlett for the opportunity kindly afforded me in their laboratories, and for much kind assistance throughout this work. To Lieutenant-Colonel Gordon also my best thanks are due for his kind assistance throughout, and supply of the necessary cultures and nutrient media.

Conclusions.

(1) The meningococcus survives exposure to Ringer-Locke solution.

(2) Sodium bicarbonate (0·02 per cent and 1 per cent) in sodium chloride solution exerts a toxic effect on exposures of sixty minutes; a 2 per cent solution has no toxic effect.

(3) CO_2 and other acids in small concentration exert a toxic effect.

(4) In Ringer-Locke solution containing free CO_2 twenty-two vols. per cent and upwards, the meningococcus does not survive exposure of twenty minutes. In sodium chloride solution the toxic effect is more marked.

(5) The toxic action of serum through which CO_2 gas has been passed is pronounced.

(6) Lactic and acetic acid in M/5000 and M/2500 respectively (in 0·9 per cent sodium chloride solution) have a similar toxic action on the meningococcus.

(7) The preliminary experiments on the hydrogen ion concentration have not yielded sufficiently definite results to determine at what point the toxic action is exerted, and do not exclude a specific action of its own on the part of CO_2.[1]

(8) It is suggested that normal solutions containing increased amounts of CO_2 or lactic acid may, as physiological antiseptics, be employed in the local treatment of areas, intrathecal and naso-pharyngeal, infected with meningococci, and that even the CO_2 normally occurring in the plasma and body fluids may form part of the protective processes of the body.

(9) Preliminary experiments show that CO_2 in sodium chloride solution

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[1] Attention may here be drawn to the results of K. Taylor (*Lancet*, i, p. 294, 1917), which I only became acquainted with after my own work was completed. He has investigated the concentration of various acids inhibitory to bacterial growth. He does not mention CO_2, and regards his results as proving a specific action of acids without making any reference to hydrogen ion concentration. It is worth while, however, pointing out that if their correctness be assumed it is impossible to explain them in terms of the hydrogen ion. The ratio of the concentration toxic for one organism (even when recalculated molecularly, taking, e.g., acetic and propionic acids) is inverted in the case of another organism. This would nessitate the assumption of an inverse relation between molecular concentration and hydrogen ion concentration in either one or other of the two acids.

exerts a rapid toxic effect on the protozoon opalina; and on *S. pallida*. It is not impossible that CO_2 might also be made use of in syphilis of the central nervous system, and in diseases due to protozoa.

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THE SYMPTOMS OF ACUTE CEREBELLAR INJURIES AS OBSERVED IN WARFARE.

By Lieutenant-Colonel GORDON HOLMES.
Royal Army Medical Corps.

(*Continued from page* 570.)

Disturbances of Speech.

Apart from the oculomotor, the only cranial nerves of which the functions are obviously affected by unilateral cerebellar lesions are those which are concerned in phonation and articulation.

Speech is abnormal in most cases in which the lesions are recent and severe; it is usually slow, drawling and monotonous, but at the same time tends to be staccato and scanning. This gives it an almost typical "sing-song" character and makes it indistinct and often difficult to understand. In a few patients speech was in fact quite unintelligible for a time. In many cases the utterance is remarkably irregular and jerky, and that of many syllables, especially, as Marie has pointed out, of those that end a sentence, tends to be explosive.

Phonation is as a rule more affected than articulation, though both vowels and consonants are slurred and uttered unequally and irregularly. All classes of consonants too are affected, but articulation sometimes has a special nasal character and the labials particularly tend to be explosive.

Another striking feature is the apparent effort necessary to utter a series of syllables or a sentence; the attempt is associated with excessive facial grimacing and speech has consequently a laboured character that often recalls a pseudo-bulbar paresis. A few of the patients also showed a tendency to burst into explosive and excessive laughter when amused.

These abnormal features subside as a rule rapidly, but in a few cases the speech was not yet natural two or three months after the infliction of the wound.

Reflexes

Striking alterations in the reflexes is not a prominent or very obvious symptom in the clinical examination of patients with cerebellar lesions, but they are frequently abnormal, or when the injury is unilateral they may be unequal on the two sides. The change can be best studied in the knee-jerks in cases in which the injuries are limited to one-half of the cerebellum, but they can also be seen in the arm- and in the ankle-jerks.

When the knee-jerks are elicited as the patient either lies in bed or sits with his legs hanging freely, that of the healthy side seems unaffected, but the homolateral jerk is at first often feebler, less brisk and less easy to elicit; or a response may be obtained from one or two only of a series of

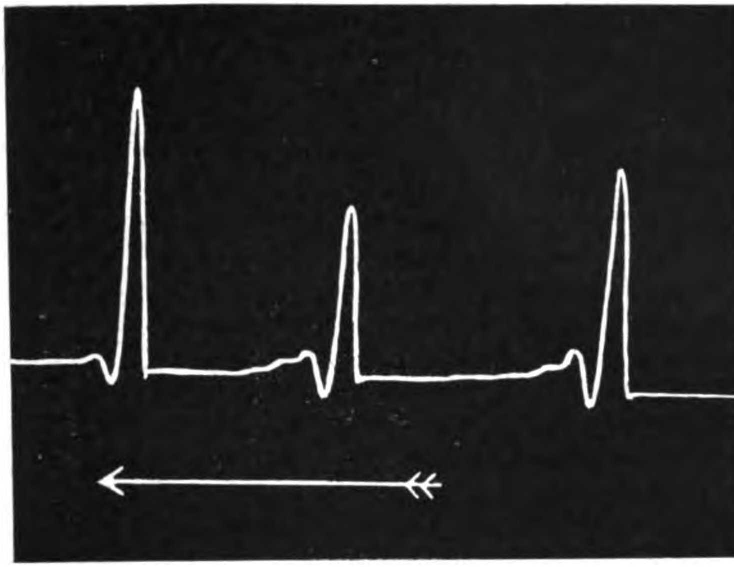

Fig. 11.—Tracings of three knee-jerks of a normal man taken on a slowly revolving drum. Read from right to left. The slight secondary swing seen in these tracings does not occur in many normal men.

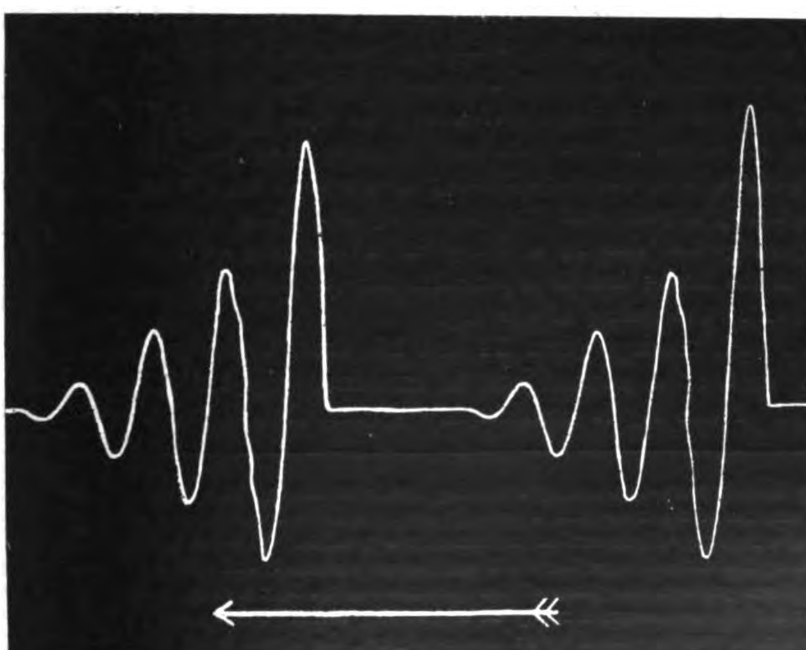

Fig. 12.—Tracings of two knee-jerks of a man with a right-sided cerebellar lesion of eight years' duration. Tracing is less reduced than that in fig. 11. Read from right to left.

taps on the patellar tendon, though the range of the jerk is then generally large and ample. In a few cases the jerks were wholly absent during the acute stages of the illness, unless reinforcement was employed.

When the patellar tendon is tapped as the patient sits on a high chair so that his legs are unsupported and can swing freely, the jerk of his homolateral leg when compared with that of his other limb appears less brisk, often slower, and it lacks that decisive, forcible character of the normal knee-jerk, though its range may be as large or even greater. Further, while the normal limb falls deliberately to its original position and quickly comes to rest, that of the affected side often continues to swing inertly to and fro for a time like a pendulum; the jerk has consequently the pendular character described by André-Thomas. This feature can be seen by comparing fig. 11 and fig. 12.

But in order to study more fully this change in the reflex it is necessary to record the movement of the leg on a more quickly moving drum.[1]

By this means I found that though from unaided observation the jerk was frequently described as slower or less brisk, there was no increase in the latent period as recorded by the apparatus I have employed. In several normal persons this, when measured from the instant the tendon was struck to the commencement of the movement of the leg, varied between 0·038 sec. and 0·054 sec., being in the majority 0·043 sec., which agrees approximately with the latent time obtained in man by Franz, by Guillain, Barré and Strohl and others by tambours placed on the quadriceps extensor. In the patients with cerebellar injuries in whom I have similarly recorded the jerk the latent period always lay within the same limits; in one man with a very severe lesion it constantly approached the lower figure. The apparent slowness is consequently not due to a delay in a response or to a slower movement of the limb; but it is probable the subjective interpretation of the inertness in the swing of the leg.

But such tracings (figs. 14 and 15) show other important changes. When that of a normal jerk is examined (fig. 13) it is obvious that the fall of the leg is considerably slower than its rise, and the curve

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[1] My records were obtained by attaching firmly to the leg, at a fixed distance below the axis of rotation of the knee-joint, a properly shaped splint which carried a rod attached to it by a joint at which only slight vertical movement was possible. This rod was connected by a ball-and-socket joint with a longer bar which could move accurately and with a minimum of friction through three guides in the plane of the movement of the leg: a suitable marker fixed to this bar recorded the movement directly on a revolving drum. The moment of the tap on the patellar tendon was registered by an electro-magnet, the circuit being closed when the metal hammer, to which one terminal was connected, came in contact with a copper wire placed in close contact with the skin over the patellar tendon. Time was recorded by a tuning-fork of 128 vibrations per second (C°).

does not therefore correspond with the oscillations of a pendulum. Evidently then a tonic contraction, or state of tone, in the extensor muscles prevents the immediate fall of the normal leg to the abscissa. This fact is already known from the records obtained by various methods in experimental animals and in man. I have found the time

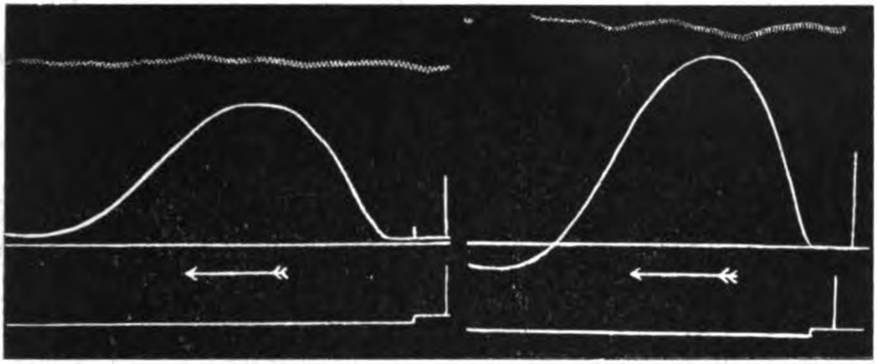

FIG. 13.—Tracings of the knee-jerks of two normal men recorded in a rapidly revolving drum. Read from right to left. Time by a tuning-fork of 128 vibrations per second. Reduced to one half.

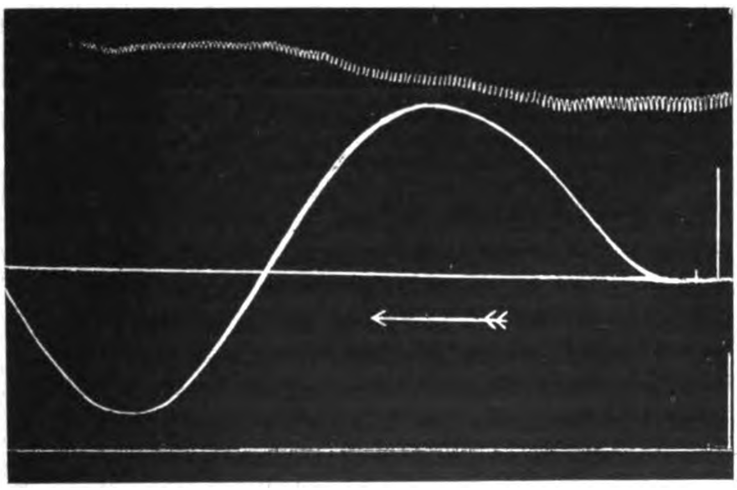

FIG. 14.—Tracing of the right knee-jerk of a man who received a severe injury to the right side of his cerebellum eight years previously. Read from right to left. Time by a tuning-fork of 128 vibrations per second. Signal on the lowest line.

of the rise in relation to that of the fall in several controls to vary between 1 to 1·2 and 1 to 2·2. In the curves obtained from the affected limb in men with cerebellar injuries the fall to the abscissa is on the other hand almost invariably more rapid than the rise (fig. 14); in the

cases in which I have measured it the relation of the duration of the rise to that of the fall of the curve averaged 1 to 0·85. Here there is consequently no evidence of tone or muscular contraction impeding or delaying the fall of the limb under the influence of gravity, and the falling limb acquires sufficient velocity to make it swing, provided its oscillations are not resisted by the tone of the muscles that move the knee-joint. These oscillations give regular curves which have all the features of those of a pendulum; and it can be easily ascertained that they are not associated with any active contractions of the extensor or flexor muscles of the knee.

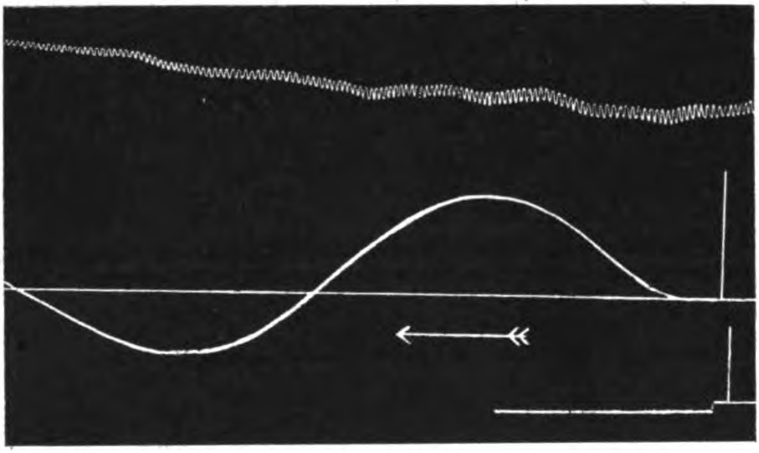

FIG. 15.—Tracing of the right knee-jerk of a man with an extensive injury of the right side of his cerebellum, obtained ten weeks after the infliction of the wound. Read from right to left. Time by a tuning-fork of 128 vibrations per second. Signal on the lowest line.

There is another feature in the knee-jerk of the affected side which can be easily detected by careful observation. If the observer places one hand across the hamstring tendons behind the normal knee he can generally feel a brisk tightening of these tendons, due to contraction of the flexors of the knee, at a very short interval of time after the patellar tendon has been struck, providing that this produces a jerk of sufficient range. Palpation of the flexor muscles shows that this tightening of the tendons is due to their active contraction, and not merely to passive stretching by the extension of the knee. On the affected side, however, no such contraction of the hamstrings can be felt, no matter in what position the knee is placed, or how great the amplitude of the jerk may be. One result of this may be seen if, while the two limbs are fully supported on the bed with the hips and knees semiflexed and the thighs rotated outwards so that the heels are at the same level, the patellar tendons are tapped in succession; the foot of the affected side is moved abruptly towards the bottom of the bed by each jerk that is elicited, but it returns, or tends to return, immediately to

its original position, while on the affected side the foot generally remains in the position into which it has been moved by the contraction of the quadriceps, and the knee can be in fact often fully extended by a series of taps on the patellar tendon. This failure of the contraction of the hamstrings and of the consequent pull back of the leg was present in all my cases of severe injury, and its occurrence was repeatedly confirmed by independent witnesses. It usually persists as long as there are obvious disturbances in the movements of the limb; it was very striking in a patient who had received his injury eight years previously.

The ankle-jerk is less commonly abnormal, though when the knee-jerk is depressed or difficult to elicit this reflex is usually more so. In five of my cases, however, in which there was no evidence of involvement of the pyramidal tracts, a short ankle-clonus could be obtained on the affected side; it resembled that due to organic disease but did not persist on continued pressure on the sole; in fact, as a rule it consisted of a few jerks only.

In many cases the flexor and extensor reflexes of the elbow were less brisk than on the normal side. In these reflexes it is less easy to detect a concomitant reflex contraction of the antagonists of the contracting muscles, but when the forearm is allowed to hang unsupported it frequently tends to swing in the pendular manner described by André-Thomas, especially after the triceps-jerk has been elicited.

No difference in the superficial reflexes, the abdominal, cremasteric and plantar, of the two sides could be detected in even the severest unilateral lesion, and in every case they presented their normal characters.

Sensation.

Finally we have to consider the state of sensation in cerebellar lesions. This is an interesting and important point, since Lussana regarded the cerebellum as an organ of the "muscular sense," and Lewandowsky has attributed many of the motor abnormalities to disturbance of muscle sensibility, meaning thereby those sensations evoked in consciousness by the state of contraction of the muscles, and by movement and the position in space of different portions of the body.

I have, however, examined every modality of sensation in many cases but have never found disturbance of any form, nor have I detected any evidence that would point unequivocally to any alteration of it. No matter how irregular the movements may be, or how far the affected limb deviates from the point to which it should be moved, the patient always has a full and accurate recognition of its position in space.

It is true that, as Luciani observed in animals, the withdrawal of a limb that is pricked and the reaction to the prick, are occasionally less brisk on the homolateral side when the lesion is early and extensive, but

2

no alteration in the threshold of, or diminution in the acuity to, tactile and painful stimuli, or even subjective differences between the sensations similarly evoked on the two sides, ever existed.

Lotmar has described a disturbance in the appreciation of weights by the affected hand, and Maas and Goldstein have supported his statements, but in none of their three cases was a lesion limited to the cerebellum demonstrated anatomically; there was for instance a diffuse cysticercus meningitis with hydrocephalus in Goldstein's patient. All three authors base their conclusions on the fact that when weights were simultaneously placed in his two hands the patient usually under-estimated that on the affected side. I have investigated the appreciation of weights in eleven cases with extensive unilateral lesions, and in some of them on several occasions. In two no disturbance existed, but in the others it was found that if while the arm was still asthenic identical weights were placed in his two hands, his eyes being closed, the patient frequently did not recognize that they were equal, and in almost every case stated that the heavier was in the affected hand. When unequal weights in which the difference was relatively small but appreciable, as 80 grm. and 100 grm. or 200 grm. and 240 grm., were placed in his hands, his replies were correct when the heavier lay on the affected palm, but often wrong when the normal limb carried it. Consequently the ability to recognize the identity or inequality of weights lifted simultaneously by the two hands was affected. In all these cases the tendency was to call that on the affected palm the heavier, except one man who at first occasionally described that borne by this hand as lighter, though in all subsequent examinations when the weights were equal or approximately so, that in the affected hand seemed to him the greater. But obviously these observations cannot be accepted as evidence of disturbance in the appreciation of weight, since by every paretic limb weights are adjudged heavier than they actually are, even though sensibility is unaffected. The greater effort which a patient suffering from a unilateral cerebellar lesion must put into all attempts to move the homolateral limbs suggest strongly that he will necessarily over-estimate, or estimate wrongly, the resistance which these movements encounter. Whether any disturbance in the appreciation of weights exists can be decided only by testing his ability to discriminate between two weights within the normal threshold of difference which are placed successively in this hand. This was done in all my eleven cases. The difference-threshold for the unaffected hand was first carefully ascertained and then a series of observations was made by placing the same two weights in succession in the affected hand. By this method no loss or defect in the appreciation of weights could be detected on either side; in one patient in fact the difference-threshold for the affected limb was considerably smaller than in the other and in several normal persons

who were tested at the same time, but this was explained by the fact that he had been a mica dealer in Canada and accustomed since childhood to "weigh" his wares in his left hand.

The following records, selected from a long series of observations which were obtained nineteen days after the infliction of the wound, in a man with an extensive lesion in the right half of his cerebellum, illustrate these facts.

Right hand	Left hand	Reply
200 grm.	200 grm.	Right heavier
200 ,,	200 ,,	,, ,,
200 ,,	200 ,,	Equal
200 ,,	200 ,,	Right heavier
200 ,,	200 ,,	,, ,,
200 ,,	200 ,,	,, ,,
200 ,,	150 ,,	,, ,,
150 ,,	200 ,,	,, ,,
150 ,,	200 ,,	Left heavier
200 ,,	150 ,,	Right heavier
200 ,,	150 ,,	,, ,,
150 ,,	200 ,,	Equal
150 ,,	200 ,,	Right heavier
200 ,,	150 ,,	,, ,,

But when the discrimination of weights was tested by placing two weights successively in the one hand he gave the following replies:—

First weight	Second weight	Right hand	Left hand
100 grm.	80 grm.	Correct	Correct
100 ,,	80 ,,	,,	,,
80 ,,	100 ,,	,,	,,
100 ,,	80 ,,	,,	,,
80 ,,	100 ,,	Equal	Equal
80 ,,	100 ,,	Correct	Correct
200 ,,	150 ,,	,,	,,
150 ,,	200 ,,	,,	,,
150 ,,	200 ,,	,,	,,
200 ,,	150 ,,	,,	,,
200 ,,	150 ,,	,,	,,
150 ,,	200 ,,	,,	,,

We must therefore conclude that no form of sensation is disturbed by cerebellar disease, and that though the patient often cannot compare correctly weights placed at the same time in his two hands, this does not depend directly on a disturbance of the faculty of appreciating and discriminating weights.

All the evidence available from the careful investigation of sensibility in cases of cerebellar lesions in man, in whom alone it can be properly tested, shows conclusively that this organ is not concerned in the trans-

mission, or in any modification or elaboration, of those afferent impulses which give rise to conscious sensations.

Symptoms due to Lesions of the Vermis.

I have not yet seen a case in which a gunshot wound produced a lesion limited to, or affecting mainly, the vermis of the cerebellum, though this was undoubtedly involved in some of the unilateral and in most of the bilateral injuries. Consequently the only conclusions on this point that can be drawn from my material must be by comparison of the symptoms in cases where one lateral lobe only was affected, with those present in which the vermis also was injured. But unless the differences in the symptoms of these two groups of cases are essentially distinct in one or more particulars they cannot be forthwith regarded as indicating a special physiological significance of the vermis, in view of the evidence of functional localization in the cerebellum which has been brought forward within recent years.

No essential difference can be detected when the symptoms due to lesions strictly limited to one lateral lobe are compared with those of cases in which the vermis is in addition involved, though in relation to the extent of the damage the functional disturbances are somewhat greater and recover less rapidly in the latter. The hypotonia, the abnormalities in the voluntary movements of the limbs, the changes in the reflexes and the nystagmus differ in no essential particular. Even the affection of gait and of equilibration, which has been attributed by certain authors (Thomas, Rothmann) to injury of the vermis, was not more pronounced when the lesion included this, provided it did not extend sufficiently beyond the middle line to produce symptoms in the opposite limbs. Two patients, for instance, were under observation at the same time—in one a piece of metal was removed from the lateral part of the left lateral lobe and considerable destruction of tissue was found around it, while in the second a large piece of shell-casing was extracted from deep in the mesial portion of the right lateral lobe, practically through the paramedian fissure, and a hernia which must have involved the vermis developed. The first man attempted to walk fifty-eight days, and the second seventy-one days, after the infliction of the injury and both succeeded equally well in walking and in maintaining equilibrium. Further, there was no striking difference in the characters of their gaits.

When the injury extends so far over the middle line as to produce also disturbances in the opposite limbs, gait and the maintenance of equilibrium are naturally more seriously affected than when one side only is involved.

The only special features of vermis affection that I have observed

are greater disturbances of phonation and articulation, and more pronounced tremor and greater difficulty in movement of the head and trunk when the patient sits up, but even in these respects the symptoms do not differ in nature from those produced by injury of both lateral lobes.

Symptoms of Bilateral Lesions of the Cerebellum.

In seven of my cases both sides of the cerebellum were injured; in four the missiles had passed transversely or obliquely through the organ, and in the other three there were tangential wounds which fractured and depressed the occipital bone over it. Four of these patients died; in one, who had a penetrating wound, the posterior margins of both hemispheres (lobi semilunares superior and inferior) were extensively damaged, but the vermis was injured only superficially in the region on the declivum; in two cases there were depressed fractures with extensive hæmorrhages and superficial softenings in each lateral lobe, but the vermis escaped, while in the fourth large portions of the vermis and both lateral lobes were destroyed by hæmorrhage.

All these cases presented the same symptoms, and no striking difference in nature could be detected between those in which the vermis was involved and those in which it escaped. The limbs of both sides were affected, but the disturbances of their movements differed in no essential particular from those that result from unilateral lesions. Speech was, however, very much disturbed; it was slow, drawling and scanning, and many syllables were uttered explosively. In two men it was so indistinct as to be scarcely intelligible. The muscles of the trunk and neck were very hypotonic, and the patients had difficulty in holding their heads in any attitude if it was unsupported, and in sitting up if unaided. The power of standing and walking could be observed in only one of these patients, and in this man gait particularly was more severely affected and the maintenance of equilibrium was more difficult, than in any case with a purely unilateral lesion.

Symptoms produced by Lesions of the Cerebellar Nuclei.

It is extremely difficult to determine the part played by damage of the nuclei in the symptomatology of these cerebellar lesions. Most penetrating gunshot wounds produce diffuse damage owing to the occurrence of hæmorrhage, œdema, softening and septic infection in the parts around them, and the nuclei, the dentate in particular, are consequently very liable to be involved even when the wound of the cerebellum is relatively superficial. On the other hand, when the nuclei are involved by such injuries a portion of the cortex is also destroyed. We can consequently decide which functional disturbances are associated with nuclear lesions only by comparing the symptoms of superficial with those of deep wounds.

In the first place we find that when the lesion is so superficial that the nuclei cannot have been directly injured the symptoms are less intense, less regular, and that they disappear much more rapidly. Several such cases could be cited, but two will suffice.

Case 1.—Captain J. was wounded by a fragment of shell and became immediately unconscious. When he was seen two days later a contused penetrating wound was discovered three centimetres below and 2½ centimetres to the left of the inion. An X-ray photograph revealed a piece of shell-casing, which had been driven through the skull, immediately under the wound. This and pieces of depressed bone were removed next day; a moderate area of destruction existed in the cerebellum, but it seemed to be superficial. By measurement it was found to correspond to the inner third of the lobus gracilis.

When he was first seen he presented all the symptoms of a severe cerebellar injury. He had difficulty in deviating his eyes to the left, and when he brought them over there was coarse, slow, regular and well-sustained nystagmus of large amplitude; on looking to his right the movements were smaller, more rapid, less regular and less well sustained. No nystagmus occurred on looking downwards, though intermittent but fairly regular jerks developed when his eyes were deviated upwards. His speech was slow, forced and scanning. His right limbs were unaffected, but the left were very hypotonic (all groups of muscles were equally so), slow in all movements though not appreciably weak, and their voluntary actions were disturbed by dysmetria, aimless deviations from the direct line of movement, dissociation into their component movements, and by the occurrence of tremor towards the end of the action. Adiadochokinesis and the rebound sign were marked in both arm and leg, and the left arm tended to swing outwards when outstretched, and deviated outwards in Bárány's pointing test. Yet twenty-four days after the infliction of the wound this patient was able to walk and use his limbs quite well, and did not complain of any abnormal symptom. On examination, however, it was found that some nystagmus still developed when he looked fully to the left, hypotonia was still demonstrable in the left arm, but this limb was now only slightly slow and awkward in attempting rapid alternate movements, and it still deviated outwards in the pointing test.

Case 2.—Private R. was wounded by a piece of shell-casing. He did not become unconscious, but in attempting to stand up staggered like a drunken man and fell to the left. When he arrived in a base hospital two days later a gutter wound was found extending from the middle line two centimetres below the inion towards the tip of the left mastoid. An X-ray examination showed fracturing with depression of bone fragments to a depth of 1½ centimetres under the inner portion of the wound. (This corresponded to the inner part of the lobus semilunaris inferior and the upper margin of the lobus gracilis.) These fragments were removed from the cerebellum and the wound was cleaned and drained.

When he entered hospital he had slow, coarse, sustained nystagmus in looking to his left, fine and more rapid movements on deviation to the right, and hypotonia, slight paresis and considerable ataxia of his left limbs. Twelve days later, however, he could use his limbs quite well, walk safely and on examination he presented practically no abnormal symptoms.

Such cases, in which the lesions were in all probability superficial, suggest strongly that the ordinary symptoms of a destructive injury are usually transient and recover rapidly if the deeper parts of the cerebellum, and especially the nuclei, are not directly or indirectly involved. Certainly such rapid improvement is never seen when the damage extends to the neighbourhood of the central nuclei.

On the other hand, these superficial lesions produce all the symptoms that are found when the nuclei too are injured, and they differ from these only in degree.

Consequently, as far as my present observations permit, it must be concluded that the effects of nuclear and of cortical lesions of the cerebellum differ in no essential particular, though those produced by the latter are less intense, less regular, and recover more rapidly.

These statements can refer to the nucleus dentatus only, as I have seen no case which survived long enough to permit thorough examination in which there was reason to believe that the roof nuclei were involved. If a wound extends so deep, it is very liable to open the fourth ventricle and lead to an early fatal termination. The dentate nucleus, however, is only two or three centimetres deep from the posterior surface of the cerebellum, which is the site of most gunshot injuries.

The Nature of the Symptoms produced by Cerebellar Lesions.

A study of the symptoms of destructive lesions and a determination of their constancy and relative importance will form a sufficient basis for the clinical diagnosis of diseases of the cerebellum, but in order to obtain an insight into the normal functions and the physiological properties of this organ it is necessary to analyse and attempt to resolve these numerous functional disturbances into their simplest components.

This is unquestionably a difficult task; in the past it has been the subject of much discussion and controversy among physiologists, who can deal with simpler factors and possess means of measurements that are not available to the clinician; the clinician, however, has the advantage that he can rely on the intelligent co-operation of his patients and consequently employ more numerous and better adapted methods for observing the effect of various lesions. Certain problems indeed, as the occurrence of sensory disturbances, can be decided only by clinical observations.

The first point which demands attention is the nature of the symptoms already described. Are they to be attributed to destructive or to irritative lesions of the cerebellum? Their constancy, their regularity, their persistence for long periods, and especially their nature, suggest strongly that they are directly due to destruction and that they are consequently negative or defect phenomena. In the case of many of them, as the

muscular atonia, this cannot be doubted, and indeed careful observation makes it probable that irritative effects are minimal after gunshot injuries of the cerebellum in man. Those forced movements and attitudes which Luciani has tentatively termed "dynamic phenomena," that occur so commonly after experimental injuries in animals, are very rarely seen in man, or occur at least only as immediate symptoms. Vertigo, if it is to be included among the true cerebellar symptoms, is more probably of irritative origin; its inconstancy, its variability, and the facts that it occurs only early after the infliction of the injury and is rarer in gunshot wounds than in cases of tumour or abscess, favour this view. It may be consequently safely assumed that the functional disturbances with which we have to deal are produced only by negative or destructive lesions of the cerebellum.

It is worthy of note that, as von Monakow has pointed out, symptoms referable to the effects of shock or diaschisis on other parts of the nervous system are rarely obvious.

Atonia, or diminution of that slight constant tension which is characteristic of healthy muscle, is such a constant and striking feature of all early injuries, and persists for such long periods when the wounds are large, that it is obviously a primary and direct symptom.

The state of the tendon-jerks has been generally taken by clinicians as a measure of tone, and yet it is the rule that even in the toneless limb of a cerebellar patient the knee-jerks and similar reflexes are not abolished, and the excursion of the jerks may be even larger than on the normal side. Physiologists too (Risien Russell, André-Thomas) have found the homolateral reflexes exaggerated after unilateral experimental ablation. But tone is dependent not only on the activity of the direct spinal reflex arc, the integrity of which is essential for the presence of the knee-jerk, but on other factors too, as on labyrinthine and cerebellar influences; or rather that state we call tone is influenced by several factors and the presence of the knee-jerk indicates only the activity of one, that is of the spinal reflex arc. Consequently the presence of the knee-jerk is not an argument against the existence of atonia in cerebellar disease.

But even when septic infection and the effects of increased cerebrospinal pressure can be excluded the knee-jerk and the other tendon reflexes are in some cases depressed, or they may be even for a time absent, on the side of an early and extensive lesion. As far as clinical observations go this seems to be generally associated with an extreme atonicity of the muscles, but their relation is probably not direct. The depression of the reflexes may be due to transient shock or diaschisis as it is an early hemiplegia; or it is perhaps owing to the fact that the muscles are so atonic that a tap on the tendon does not produce a sufficient increment of tension in them to be an adequate stimulus. The common observation

that a reflex response can be frequently elicited by only one of a series of taps, or when the knee is in a certain position, and that it is then quite brisk, favours the latter hypothesis.

Recent physiological investigations (Sherrington, Langelaan) have shown that tone is a more complex condition than has been generally realized by clinicians; it may indeed be a compound state, its separate components being perhaps dependent on distinct elements of the muscle fibres, and possibly on separate innervation.

If these views prove correct it will be the task of experimental physiology to determine what component of tone is affected by cerebellar injuries. The study of the knee-jerk by the graphic method shows that the tonic contraction of the quadriceps, which prevents the free and immediate fall of the extended leg under the influence of gravity, is absent or diminished when the homolateral side of the cerebellum is injured; the jerk has then the character of that described by Sherrington when the reflex excitability of postural contraction is low, or when what Langelaan calls plastic tone, that is the slow yielding of the extensor muscles to a continued stress, is absent or diminished.

Langelaan has indeed already suggested that decerebrate rigidity is partly due to a spasm of the muscle sarcoplasm of sympathetic origin owing to the prevailing influence of the cerebellum, but Horsley and Clarke found that decerebrate rigidity persists after destruction of the cerebellum, unless the paracerebellar nuclei too are injured, and Sherrington also states that the cerebellum can be removed without the posture in this condition being annulled.

It appears obvious however that the various symptoms of atonia described above can be attributed to this loss or diminution of postural contraction or plastic tone; its absence abolishes the normal resistance of the various segments of the limbs to passive movement, leaves the muscles less elastic to sudden stretching, and makes them soft and flabby to palpation.

Clinical experience, therefore, fully confirms the statements of Luciani and other physiologists that atonia is a constant, important and striking result of acute cerebellar destruction. It diminishes gradually in time, and may, like all the other symptoms, disappear, at least if the lesion is not very extensive. I have, however, at present no definite observations on this point, nor will it be possible to obtain satisfactory conclusions until we possess a reliable clinical method of measuring tone.

The remarkable fact that atonia as a symptom of cerebellar disease has received little attention from clinicians is probably due to its gradual decrease after the onset of acute lesions, and to its compensation *pari passu* with the progress of degenerative and atrophic diseases. Babinski, for instance, states that even in particularly severe cerebellar affections

he has found no atonia, and André-Thomas in 1911 wrote that he had never observed muscular relaxation or hypotonia, in the sense which is given to it by clinicians, in any patients he had examined.

The latter author, however, in 1914, elaborated in conjunction with Durupt an hypothesis, foreshadowed by Rothmann, according to which focal lesions of the cerebellar cortex produce a condition of anisosthenia, or hyposthenia of certain muscles and hypersthenia of their antagonists. Of this condition I could find no evidence either when only local circumscribed lesions existed, or as the symptoms of more extensive injuries cleared up.

The next group of symptoms that claims our attention are those seen in voluntary movement. Certain of them are most easily studied in simple actions against resistance. It has been shown that when a man with a cerebellar lesion attempts to grasp the observer's two hands simultaneously: (1) the power exerted by the affected limb is defective; (2) the initiation and the execution of muscular contractions and relaxations are slower than on the normal side; (3) the grasp is often intermittent and irregularly maintained; and (4) the affected limb tires more quickly than its fellow. These symptoms can be equally well demonstrated in other actions.

Asthenia.—This term, which Luciani has applied to the diminished functional energy of the affected limb, may be conveniently used to describe their lack of normal power in movements that demand its exertion. It differs so definitely from the paralysis and paresis produced by disease of the motor system that it is advisable to designate it by a distinct word.

That any degree of feebleness is ever produced by cerebellar lesions has been denied by many, and others who have observed it have attributed it to pressure on the motor tracts (Rothmann), to co-existing cerebral foci, to atonia, or to ataxia (Mann). In the early stages of every severe injury it is, however, easily determined that the homolateral limbs are feebler than their fellows, and when their strength is measured a very considerable reduction of power may be found in all groups of muscles, though it is usually more obvious in the arm than in the lower extremity. The greater effort necessary to deviate the eyes fully towards the side of the lesion, and the frequent defect in the range of their movement in this direction, is another manifestation of this asthenia. It has been already emphasized that the asthenia is not due in any large part to ataxia or awkwardness of the limb and a consequent misdirection of its energy; and though it is usually most definite when the limbs are very hypotonic it cannot be attributed to loss of tone, as these two symptoms bear no relation to one another. Asthenia must be consequently regarded as another primary and immediate symptom of cerebellar injury. It is probably pronounced only when the cerebellar nuclei are

involved. The abnormal fatiguability of the affected limbs is associated with, and may be regarded as a result of, this asthenia.

Slowness in movement has been noticed by both clinical and experimental observers. It is certainly not willed or intentional as André-Thomas states, nor can the delay be attributed to time lost in "taking up slack" in the atonic muscles, since the latency of toneless muscle is very short (Sherrington), and this explanation would not account for the closely associated delay in relaxation. And since it occurs in the simplest actions, as in simple flexion of the fingers or elbow, it is obviously not dependent on the inco-ordinate and inappropriate muscular associations which disturb voluntary movements. Finally there is no evidence that a contraction or state of increased tone of the antagonists delays or impedes the shortening of the contracting muscles.

In order to understand its nature it is necessary to study simple actions, and if possible by the aid of the graphic method. It is then seen that it is due both to delay in starting the contraction and to slowness in completing it. Further careful examination shows that there is usually associated with it a similar delay in commencing and completing the relaxation of the same muscles, which is occasionally even more pronounced. This slowness may be due to retardation of the impulses that excite voluntary muscular contractions; or to the fact that certain nervous mechanisms concerned in the production of voluntary movement react too slowly to these cerebral impulses; or it may be dependent on a state of the muscles owing to which their contractions and relaxations are retarded. As there is no evidence or probability that the cortical motor centres from which these impulses come are in any way affected the first of the hypotheses may be excluded. And as there is not a corresponding delay in the contractions and relaxations of muscles that are excited electrically or reflexly there is not sufficient basis for the third possibility. It consequently seems that the cerebellum exerts an influence on the nervous mechanisms, most probably on the spinal, immediately concerned in the execution of voluntary muscular contractions, by virtue of which these react promptly to cerebral impressions.

The cerebellum might be therefore regarded as a motor reinforcing organ, in the sense in which Luciani and others have used this term. It seems, however, probable that it takes no direct part in the processes, whether initiated reflexly or voluntarily, that produce motor effects, and that it does not augment these, but that it "sets" or "tunes," or regulates the activity of certain motor mechanisms, most probably spinal, so that the response to a volitional stimulus is immediate, effective and proportional to the intensity of the cerebral impulse.

Closely associated with asthenia is the discontinuity and irregularity in the maintenance of muscular contractions. This disturbance can be

observed in almost all voluntary movements and in the contractions of muscles concerned in maintaining posture (static tremor), but it is most easily studied in actions that demand the exertion of power; in these the contractions reach their maximum slowly and intermittently, and while in the normal limb a forcible contraction can be maintained regularly for some time, the grasp or other action which the patient attempts with the affected limb is often discontinuous and irregular, and it is frequently interrupted by sudden relaxations. The outstretched arm if unsupported often, for instance, falls suddenly, and in walking the affected leg frequently gives way under the patient without any apparent cause. The tremor that occurs in maintaining an attitude and in voluntary movements is due to this defect in the regularity and stability of the muscular contractions. Luciani has described this condition as *astasia*, and has attributed it to the imperfect fusion and summation of the single twitch contractions. Patrizi has indeed shown experimentally that cerebellar lesions lead to an incomplete fusion of the elementary twitches in muscles.

Astasia is not, however, such a prominent symptom in most local lesions of the cerebellum in man as it is in animals after experimental destruction, though it varies in degree in different cases. It does not seem to stand in any close relation to the atonia and it is probably not in any way dependent upon it; it is, on the other hand, intimately associated with asthenia. Consequently, in addition to that function by virtue of which it assures that the motor response to a voluntary cerebral impulse shall be immediate and proportional to the impulse, the cerebellum also exerts an influence on the efficiency of this response by determining the complete fusion of the elementary muscle twitches.

Clinical observations consequently confirm Luciani's conclusions that atonia, asthenia and astasia, the triad of symptoms to which he attributes all the functional disturbances, result from cerebellar lesions.

But there are other symptoms that cannot be explained by these factors only. Among them is the *rebound phenomenon* which throws considerable light on the nature of the motor disturbances. The excessive range of the after-movement may be due to absence or to long delay of the voluntary contraction of the antagonistic muscles; the fact that the patient's hand can be flung forcibly into his face shows indeed that prompt voluntary arrest is not possible, but it must be ascribed mainly to failure of the immediate reflex contraction of these antagonists when they are suddenly stretched. The absence of contraction of the hamstrings when the knee-jerk is elicited under certain conditions is a similar phenomenon; the muscles do not react normally to a sudden putting on stretch. It is true that the same may be observed in other conditions associated with loss of tone, as in peripheral nerve lesions and in tabes dorsalis, but the fact that the tendon-jerks, which must be regarded as reflexes of the same nature,

are not as a rule lost and may be exaggerated in cases of cerebellar injury shows that the atonia associated with this condition does not affect this form of reflex function. Both the biceps and triceps reflexes are in fact quite brisk in cases in which the rebound phenomenon can be demonstrated in extension and flexion of the forearm. It may be consequently assumed that the rebound phenomenon is not directly due to loss of muscle tone, but to failure of the muscles to contract promptly and efficiently when they are suddenly put on stretch. It is a manifestation of the loss of what Rothmann has called the antagonist's reflex.

On analysing the complex condition often called *cerebellar ataxia*, we meet with other facts that cannot be explained by atonia, asthenia and astasia alone. The kinetic tremor is, it is true, chiefly a manifestation of astasia, but the disturbances termed asynergia, decomposition of movement, and deviation from the line of movement, must be considered more fully.

The term asynergia here implies a defect in that accurate functional combination of the muscles which participate in a movement, that is the agonists, antagonists, synergic and fixating muscles, on which the precision and correct adaptation of the movement to its end depends. We have seen that on closing the fingers the wrist is often hyper-extended, or it extends too little or too late, and when the fingers are rapidly flexed and extended the appropriate wrist movements do not occur simultaneously. Here the co-operation of the agonists and their synergics is obviously disturbed.

Again, when the patient attempts to bring each finger in succession to the tip of his thumb all or several of his fingers flex simultaneously, and much the same may be seen when he handles a small object; this is due to the agonists and antagonists not working properly together as they must to permit the flexion of an isolated finger. Similarly, in rapid alternate movements one or other excursion is often abruptly arrested owing to disturbance in the reciprocal relations of agonists and antagonists.

And as the patient attempts to pronate and supinate his forearm quickly, various irregular and inappropriate movements occur at the shoulder, elbow and even at the wrist, owing partly at least to defective fixation at these joints.

Finally, when for example he flexes and extends his ankle alternately, the knee and hip often flex and extend simultaneously, owing, not to defective fixation but, as may be easily determined by palpation, to active contractions of the thigh and pelvic muscles. Here the intervention of muscles that should not be concerned in the action disturb its precision.

Other instances can be easily cited of all these forms of disturbance.

This affection of the normal harmony and correct co-operation in time and degree of the various muscular contractions concerned in movements and in the maintenance of posture is such an important factor in cerebellar symptoms that it claims careful attention. It is essentially an

inco-ordination or ataxia (i.e., absence of discipline or arrangement) of the active muscles, though these terms have become so vague and have given rise to so much confusion that they must be reluctantly employed. Parenthetically it may be pointed out that ataxia, when employed in its literal sense, is more correctly applicable to these disturbances than to that component of the irregularity of movement seen in tabes dorsalis, which depends upon or is influenced by loss of the sense of position, and which is consequently most pronounced when the movements of the limbs are not controlled by vision.

A disturbance in the co-ordination of the muscles engaged in individual movements must be therefore accepted as a symptom of cerebellar disease, and its acceptation does not involve the "creation of an abstract and fictitious entity, the principle of co-ordination." All actions are the product of the activity of several and subcortical centres, and though it is the cortex which initiates voluntary movement and probably selects and integrates the adequate impulses for individual acts, the elaboration and co-ordination of the numerous factors that are concerned in each must depend largely on subcortical centres. We have learned from Sherrington's work the elaborate integration of which even the isolated spinal cord is capable in reflex acts. His experiments have demonstrated that it is on the afferent impressions of the proprioceptive system that the control and regulation of the spinal reflexes chiefly depend, and numerous experiments and clinical observations have shown that this system exerts similar functions in voluntary movements. Professor Sherrington has happily described the cerebellum as "the head ganglion of the proprioceptive system," and if this view, which conforms to the anatomical connexions of this organ, is accepted it would be natural that one of its chief functions should be the exertion of a regulating and co-ordinating influence in more complex movements.

Babinski has applied the term asynergia particularly to the inability to perform simultaneously the various movements that constitute an act, and we have seen that this condition, which has been referred to here as decomposition of movement, does occur, especially in recently wounded patients. André-Thomas and Durupt attribute it partly to voluntary dissociation and partly to dysmetria. That it is often voluntary there can be no doubt; one ataxic patient for instance when given a spoon and told to place it in his mouth always brought his elbow down to his side and held it firmly applied to it before moving his hand towards his face, in order, as he explained, to control as well as possible the disorderliness of his movements. But my observations convince me that it is not always intentional, at least in its milder forms, and that it may be a result of faulty association in time and degree of the various muscular contractions that are concerned in the action.

The symptoms described under the term *dysmetria* are more difficult to interpret. Luciani, who introduced this term, regarded it as a natural consequence of atonia; according to him the excessive elevation of the leg is due to a too sudden relaxation of the extensors as the flexors contract, and he therefore refused to accept it as a primary cerebellar symptom as Schiff had previously considered it. Babinski, who has pointed out its importance in clinical symptomatology and the fact that the movements are generally excessive in range, admits he does not understand its nature, though he suggests that it may be due to removal of an inhibiting or braking function ("action frénatrice") of the cerebellum. André-Thomas regards dysmetria as the most important factor in the disturbance of movement; he formerly assumed (1911) that the influence of the cerebellum is manifested in moderating the voluntary impulse, and not in causing the antagonistic muscles to intervene, but later he has attributed it, as well as most of the other symptoms, to anisosthenia; the movement is excessive because the hypersthenic muscles contract too vigorously, and because it is arrested too late or insufficiently owing to the hyposthenic state of their antagonists. I have observed no facts that support this explanation, nor is it intelligible to me how hypermetria would, on this hypothesis, result from extensive lesions or widespread disease which must involve numerous pairs of his reciprocally functioning "dynamogenic centres." Further, movements in opposite directions at the one joint are generally both hypermetric; and, as Babinski has pointed out, excessive movements are common in chronic cerebellar disease in which there is little or no demonstrable atonia.

The main cause of hypermetria is the pathological slowness in commencing and in completing the relaxation of the contracting muscles. While delay and slowness in starting contractions may cause no pronounced disturbance of voluntary movement, a delay in the arrest of the contraction and a slowness in affecting relaxation must necessarily prolong the movement or continue it too far, and consequently make its range too great. In several of the latter cases of my series this explanation was carefully tested and in all it was found that when there was a definite tendency to hypermetria in any movement the muscles which effected it relaxed more slowly than their homologues in the normal limb.

It often seems, however, that the exaggerated movements are to some extent due to the failure of their prompt arrest by the contraction of their antagonists; when, for instance, towards the completion of the action the limb moves with gravity it is often allowed to fall inertly on the object it wishes to seize. The timely intervention of the antagonists is then absent, as it is in the rebound phenomenon, but this cannot be attributed to their hypotonia, as André-Thomas suggests, for the proper co-operation of agonists and antagonists is an integral factor in voluntary movement, and depends on the co-ordination of the subcortical centres that effect it.

But the mismeasured movements are occasionally too small. This may be due to intentional arrest—we have, in fact, seen that this often occurs—or to an under-estimation of the effort necessary to move the slow and asthenic limb; but it is chiefly a result of the defective co-ordination of the various muscles concerned in the act, which necessarily disturb its range as well as its direction.

The deviation from the correct line of movement, which is prominent chiefly in early injuries, is a natural result of the functional disturbances which have been already considered. The limb deviates, especially in the early part of the movement, because the muscles that should be employed in fixing certain of its joints and in maintaining its correct posture contract inadequately or too late. Further, since the co-operation of those concerned in it, whether they contract or relax, is no longer accurate, the moving limb is not brought in the most direct line to its object, even though the general direction of its movement is correct.

All these disturbances are well brought out by Babinski's tests for adiadochokinesis. Rapid alternate movements are slowly, awkwardly, and irregularly performed, owing to the slowness in the initiation of each, the irregularity in their range and the disturbance in the normal co-ordination of the muscles that should contract, those that should simultaneously relax, and those that should assure the correct posture of the limb. The more rapidly the movements are performed the greater is the need of accurate co-ordination, since any irregularity or defect in one must also influence the proper execution of the succeeding movements.

The same factors are responsible for the affection of speech; its slurred, indistinct, and scanning character results from the imperfect harmony of the movements and attitudes necessary in normal phonation and articulation, while the tendency to explosiveness may be regarded as a manifestation of dysmetria. The unnatural efforts which the patient puts into his attempts may be more easily interpreted as an attempt to control voluntarily the disturbances of the complex and highly specialized mechanism of speech, rather than to asthenia of the muscles of phonation and articulation. The grimaces and unnecessary contractions of the facial and neck muscles in a patient with a severe cerebellar injury often recall those that occur on the inco-ordinate attempts of a mild stammerer to speak.

We must consequently conclude that, in addition to its influence on tone, and that by which it assures the regularity and maintenance of muscular contractions and the immediate and effective response of sub-cortical mechanisms to cerebral impulses, the cerebellum also exerts a regulating and co-ordinating influence on the spinal centres that effect voluntary movements and by this means assures their harmony, precision and correct range. This does not mean that the cerebellum

puts into play the muscles necessary for the accomplishment of complicated movements. It is an organ which has evolved on the afferent rather than on the motor side of the central nervous system. But it receives and integrates proprioceptive impulses from all parts of the body, and by virtue of these it keeps the motor mechanisms in such a state of "tone" that it can react promptly and efficiently to reflex and voluntary impulses, and assures the correct co-operation of the separate motor centres that are concerned in individual acts.

After a recent injury of one side of the cerebellum the eyes when at rest tend to deviate towards the opposite side, and nystagmus occurs on movement and especially on accurate fixation. This deviation of the eyes, the greater effort necessary to move them towards the injured side, and the frequent defect in the range of movement in this direction, must be attributed to loss of an influence, probably of a reinforcing nature, which each half of the cerebellum exerts on conjugate deviation towards the same side. The effect of this loss is most evident in voluntary movement, but it may be seen, too, in the adjustment of the eyes when the head is passively rotated, and when they move reflexly to a sudden visual or auditory stimulus. As an analogous deviation is produced by unilateral labyrinthine extirpation it is probable that this function of the cerebellum depends largely on its labyrinthine afferents, but since in this condition the deviation of the eyes is towards the injured labyrinth, and the associated nystagmus differs in type, it is evident that the eye symptoms of cerebellar disease are not due merely to interruption of labyrinthine impressions; it has, in fact, been found by experiment that the impulses by which the labyrinth influences the ocular movements do not pass through the cerebellum. (Wilson and Pike.)

Further, both the nystagmus and the paretic deviation produced by cerebellar lesions, though not permanent, are more persistent than when the vestibular apparatus only is destroyed. It is probable that it is to the combination and integration in the cerebellum of labyrinthine and other proprioceptive afferents, especially those from the ocular, and possibly from the neck muscles too, that this influence on the movements and position of the eyes is due.

The *nystagmus* is closely related to this symptom. When a patient attempts to look towards the injured side the eyes are brought over quickly, but they soon recede more slowly towards the middle line as though the muscles were too weak to maintain the position, and are then jerked back again in the desired direction. A series of these recessions and corrections constitutes nystagmus. It consists of a slow phase towards the position which the eyes assume when at rest, and a quick phase in the direction towards which they should be moved voluntarily. The range of both excursions increases the farther the object to be fixed is

from the middle line, that is, it is proportional to the effort necessary to bring the eyes into, and keep them in the correct position. The essential feature is the slow recession, which is only a manifestation of the spontaneous deviation, while the quick phase can be regarded as an attempt at correction. It has been shown by Wilson and Pike that in labyrinthine nystagmus the quick jerks are of cerebral origin, and the same is probably also true of cerebellar nystagmus. There can be no doubt that this is always more marked when the patient makes a voluntary attempt to fix an object than when his eyes are at rest or moved to order. It is interesting that nystagmus is more pronounced and more persistent in man than in animals; this is probably related to the greater development of the forebrain, and to the larger part that this takes in the execution of ocular movements.

The nystagmus that occurs on central fixation is similar. The eyes still tend to recede towards the healthy side, and their recessions are corrected by similar sharp abrupt jerks. It is important in support of the above explanation, that nystagmus on central fixation is pronounced only when a tendency to spontaneous deviation exists.

On full deviation towards the unaffected side and on vertical movements a similar nystagmus may also occur, the slow phase being towards the primary central position, or more correctly towards that point in space to the healthy side of it on which the eyes tend to deviate when at rest. It consequently seems that each half of the cerebellum has an influence, not only on conjugate movements of the eyes towards the same side but also on vertical movements and on full deviation towards the opposite side. This influence is probably closely allied to that by which the normal labyrinth assures the adjustment of the eyes to change of the position of the head in space, and is adjunct or reinforcing to the processes which effect voluntary deviations and reflex ocular movements of other origin. That this reinforcing action should be more pronounced in the ocular movements than in those of the trunk and limbs is not surprising when the greater extent to which the ordinary movements and adjustments of the eyes are dependent on subcortical mechanisms, and especially on labyrinthine impressions, is realized.

This type of nystagmus cannot be regarded as an ataxia of the ocular muscles; it is usually a well co-ordinated phenomenon in which the co-operation of the various muscles concerned in movement and fixation is undisturbed, though it may be occasionally seen that the adjustment of the visual axes to the object that should be fixed is imperfect.

The mode in which lesions of the cerebellum influence the posture of the head, trunk and limbs is more obscure. Those abnormal postures that result from unilateral lesions are much less marked and less persistent in

man than in animals, and even in these physiologists have not yet reached any definite or generally accepted hypothesis as to their nature.

The most striking and constant of the abnormal attitudes is that assumed by the head and the tendency of the affected limbs to deviate when unsupported and in movement (Bárány's pointing test). The head is as a rule inclined towards the injured side and rotated to the opposite, so that the occiput approaches the homolateral shoulder. It is noteworthy that this position also occurs after destruction of one labyrinth, and Horsley has indeed suggested that it should be regarded as a labyrinthine rather than a cerebellar attitude. It may be that it is through the cerebellum that the labyrinth exerts this posture influence.

The deviation of the limbs when unsupported and in movements uncontrolled by vision is a more important problem, since Bárány and André-Thomas have laid much emphasis on it in discussing the normal functions of the cerebellum. I have not been able to observe the anisosthenia to which Thomas and Durupt attribute it, and to explain it by the relative hypertonicity (that is, excessive tonic state) of certain groups of muscles and hypotonia of their antagonists, is, unless this condition of tone can be detected by other tests and in other movements, merely to restate the question. Since analogous deviations are produced by labyrinthine lesions, Bárány's conclusion that they are due to the interruption of labyrinthine impulses in the cerebellum is plausible.

The tendency to fall and to deviate to the injured side in standing and walking are analogous symptoms, which may be attributed to loss of motor balance between the two sides of the body owing to the removal of an influence which each half of the cerebellum elaborates mainly from labyrinthine impressions. The other disturbances of equilibrium and of gait are due to those abnormalities of movement seen in all actions of the affected limbs, and which are more pronounced the more complicated and delicate the action is, and the greater the number of muscles it employs. My observations lend no support to the view held by many physiologists and clinicians that the predominant function of the cerebellum is the maintenance of equilibrium.

Functional Localization in the Cerebellum.

The experiences of this war will probably settle the question of localization in the human cerebellum, or rather in its cortex.

It must be admitted that the results of physiological experiments are strongly in favour of it. Sir David Ferrier's electrical stimulations, Bolk's anatomical researches, and the observations of numerous physiologists as van Rynberk, Rothmann, André-Thomas and others, on the symptoms produced by small circumscribed lesions, seem at first sight to prove conclusively that a localization of function does exist in the cortex.

But when they are more carefully examined so much discrepancy is found, even between the results of experiments made in the same animal class, that they are less convincing.

Further, Horsley and Clarke's careful researches have shown that the cerebellar cortex is inexcitable to electrical stimuli; and many of the local lesions from which the most definite conclusions have been drawn extended to or involved the nuclei. And even a constant correlation between structure and functional adaptation is an unsafe argument, though a valuable guide, for the physiologist.

My own observations are of only negative value. I have attempted to determine the position of the injury in every case by careful observation at the time of operations, by a study of radiographs which revealed penetrating fractures of the skull or the presence of foreign bodies in the cerebellum, and by post-mortem examinations. For this purpose it was necessary to learn the relation of various points on the surface to underlying parts of the cerebellum; this was done by modelling plasticine to represent the covering scalp and soft tissues, on to a dried anatomical skull in which a cerebellum was placed. When the position of the entrance wound and its direction were known, an approximate idea of the region injured could be then obtained.

In many cases the primary wounds were large, and the softenings, hæmorrhages and septic processes that so frequently accompany such injuries undoubtedly increased the extent of the destruction. In others, however, only small local lesions probably existed; in three men, for instance, the missiles, a small shrapnel ball and fragments of shell casing respectively, were merely embedded in the skull, but on removing them small lacerations were found in the dura mater through which some softened cerebellar tissue escaped, and in several other cases similar circumscribed lesions were produced by small depressed fractures.

On investigating the sites of the wounds it was found that the majority involved the posterior-inferior surface of the cerebellum, most were in fact referred to the lobus gracilis, but practically every region except the anterior-superior margin was affected in one or more cases. In two patients, for example, depressed fragments of bone were driven along the under surface of the tentorium, so that the injury was almost limited to the superior surface, and in several others this surface was wounded by missiles which had entered through the occipital or parietal lobes and had penetrated the tentorium. In a few cases missiles of higher velocity had passed through different portions of the cerebellum. In some patients the lesions were more or less mesial, in others they involved its lateral part.

Final conclusions on localization can be drawn only from cases controlled by complete anatomical examinations. But, on the other hand, if there is a focal localization of function in the cortex some definite evidence of it should be obtained from such material as has been available

to me for investigation. Of such localization I could, however, find no certain evidence. When small superficial lesions existed, they produced only slight and transient symptoms which were never limited to one segment of a limb, or even to one limb. On the other hand, unilateral lesions produced symptoms which were always limited to the same side, and we can consequently assume that the functions of the cerebellum are always limited to the same side of the body.

It is true that the muscles of the head, neck and trunk, including those concerned in phonation and articulation, are more seriously affected when the vermis is injured, and disturbances of their function are usually more obvious in mesial than in lateral lesions of one lateral lobe; it is therefore probable that these activities, which require the co-operation of homologous bilateral muscles, are represented in or near the vermis.

A special interest has been given to the question of functional localization in the human cerebellum by Bárány's publications. According to his views there exist centres for the direction of movement in the cortex, and a further representation of muscles, according to the articulations they move, within these centres. He has come to this conclusion after investigating the deviations of the affected limbs when they are unsupported and in movements which are not controlled by vision, and from the fact that when local lesions exist the deviations in certain directions which are normally produced by stimulation of the labyrinth no longer occur. I have found however that a unilateral injury of any part of the cerebellum almost invariably causes deviation, both spontaneous and in the pointing test, of the homolateral arm outwards, while the vertical errors are frequently inconstant. Rothmann and others have also drawn attention to the frequency of outward deviation. Since in my cases many different regions of the cerebellum were involved, these facts are difficult to assimilate with Bárány's hypothesis of distinct focal centres for movement in different directions.

As the majority of my patients remained under observation for only relatively short periods after the infliction of their wounds it was rarely possible to test the rotation or caloric reactions. In three cases, however, both were examined, and in these it was found that immediately after the appropriate labyrinthine stimulation the homolateral arm, which had previously deviated outwards, no longer showed any tendency, or less tendency, to deviate in vertical movements; in other words, the normal reactions were not abolished, but instead of producing deviation inwards they merely corrected the outward deviation which previously existed.

The same condition was found in two other men whose cases are not included in this paper. One had been wounded in the head twenty months previously and had been operated upon. No information on the nature of the injury or on the extent of the operation could be obtained,

but there was a trephine opening over the right half of the cerebellum. He came under observation with unmistakable symptoms of disseminated sclerosis and had probably a large plaque in the region of Deiters' nucleus. There was a marked tendency to spontaneous deviation of his right arm inwards and to progressive deviation in this direction in vertical movements, which increased after rotation to the left and on irrigation of his left ear with cold water, but disappeared on rotation to the right and on irrigation of his right ear. The irrigation of his left ear with cold water in the case of a second patient whose right half of the cerebellum had been extensively injured eight years previously also only corrected the constant deviation of his right arm outwards.

If these observations are confirmed Bárány's conclusions cannot be accepted that local cerebellar lesions abolish certain deviations of the limbs which are normally produced by stimulation of the labyrinth, since these can still be elicited, though the error in movement is masked by an actual or by a latent tendency to deviation in the opposite direction, which is due to the cerebellar wound.

But though my observations lend no support to the theory of focal localization of function in the cerebellar cortex they cannot be accepted as proof that such localization does not exist.

There can be, however, no doubt that the relative prominence of different symptoms, as tremor, slowness and inco-ordination of movement, as well as nystagmus, varies with the site of the lesion. I hope to deal with the question in a later communication.

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OBSERVATIONS ON 250 CASES OF GUNSHOT WOUNDS OF THE PERIPHERAL NERVES.

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Between June, 1915, and March, 1918, 364 cases of injuries of the peripheral nerves have been admitted to the surgical division of the Norfolk War Hospital; 250 cases have come under my observation, and of these 102 cases have required operative treatment. It is chiefly upon these cases that this paper is based. An attempt has been made to follow up the cases, and to show the result obtained by operation up to the present time.

Clinical Features of Nerve Injuries.

In every case of a gunshot wound of an extremity, it is of vital importance to examine the limb for evidence of injury to the peripheral nerves. No examination of a fracture would be considered complete without an X-ray. No examination of a gunshot wound of a limb is complete without an examination of the nerves of the limb. It is of great importance that a diagnosis of a wounded nerve should be made at the earliest possible time, so that an attempt may be made to prevent the development of a useless, deformed, and contracted limb. The injuries inflicted on nerves by gunshot wounds are very variable, but by a careful consideration of the signs and symptoms produced it is possible to recognize several distinct types of lesions. The clinical progress in a large number of cases may be said to fall into one of the four following syndromes:—

(1) The syndrome of complete division of a nerve trunk. The signs and symptoms vary necessarily with the functions of the affected nerve, but taking as an example a mixed sensori-motor, such as the median or musculo-spinal nerve, the following phenomena may be observed.

Motor Phenomena.—There is immediate and complete loss of voluntary power in the muscles supplied by the divided nerve. The paralysed muscles waste and undergo degenerative changes which result in wasting and deformities known as paralytic contractions.

Sensory Phenomena.—There is loss of protopathic sensibility. Protopathic nerves respond to painful skin impressions, e.g., the prick of a pin, and the distinction between extreme degrees of temperature. Their area of distribution is badly localized, and stimulation of them gives a widely radiating tingling sensation.

There is loss of epicritic sensibility. Epicritic nerves respond to light touches, and also distinguish small difference of temperature. Their area of distribution is well defined.

Vaso-motor Phenomena.—It is stated that there is an initial rise in the temperature of the limb after the division of a nerve, with some redness and increased vascularity in the part. This is usually followed by a fall in the temperature of the part. The limb becomes pale and cold. It is often found that the temperature of the injured part varies very much with external influences—in cold weather, for instance, the injured part may assume a cold bluish appearance.

Trophic Phenomena.—A considerable time often elapses between the time of the injury and the appearance of well-marked trophic lesions. Sometimes trophic lesions will develop even after an operation has been done for the union of the divided nerve. There is a diminution in the quantity of the subcutaneous fat, the skin becomes smooth, and may be abnormally dry, the hair is harsh and dry. Often blisters develop as the result of trivial injuries, and in some cases the tips of the finger may disappear as the result of progressive ulceration. Degenerative changes also occur in the bones and small joints of the hand.

(2) *The Syndrome of Compression.*—This is an important group and contains a considerable number of cases. If the signs and symptoms in these cases be carefully considered, it will be noticed that there has sometimes been some improvement, but after a time this ceases and there may be a relapse. This relapse is almost always due to compression of the nerve by fibrous tissue, or the development of callus. Early diagnosis in these cases is very important, as they are the most favourable for operative treatment. A definite syndrome has been observed in these cases by Stopford. This syndrome consists of a dissociated type of sensory disturbance. The area in which there is a loss of sensibility to pain (tested by a pin-prick) is greater than that in which the loss to light touch occurs (tested by camel-hair brush). This syndrome is the reverse of that enumerated by Head, Rivers, and Sherren for injuries of the peripheral nerves. It is said not to be present on examination of recent injuries, but only develops at a later date. In cases of compression the motor paralysis is less marked than in cases when the nerve has been divided, and the muscular wasting is also rapid and not so extensive. Trophic lesions do not occur in cases of compression.

(3) *Syndrome of Incomplete Lesion with Irritation.*—When this condition is present the patient often complains of neuralgia pains. On examination the extremity shows a glossy shining, and mottled red skin which is often tender to stimuli. The skin in such cases is usually drawn tightly over the fingers, the subcutaneous tissue is small in amount. There is generally profuse sweating over the area of the nerve affected. The sweat is strong smelling and markedly acid in reaction. Sweating is usually not excessive, unless there is an irritative incomplete lesion.

(4) *The Syndrome of Interruption, followed by Restoration of Function.*—The cases following this course are probably examples of physiological division. The missile having passed close to the nerve and temporarily

paralysed it, there is loss of sensation and of motor power, but there is usually little or no muscular wasting. In a few weeks there is usually evidence of returning sensation, and this is followed by the restoration of tone and voluntary contraction in the paralysed muscles. These cases usually recover completely in about three months.

Macroscopic Pathological Lesions of Peripheral Nerves, due to Injury, with Special Reference to the Symptoms caused and the Treatment Necessary.

(*A*) *Lesions of Nerves which give rise to Interruption of Function with Subsequent Recovery.*—The pathological lesion in these cases is usually one of concussion of the nerve. The missile has passed through the limb near the situation of the nerve, without causing any macroscopic lesion. The nerve has been merely concussed, or perhaps temporarily stretched. With careful treatment these cases usually recover completely. In other cases the missile may have caused some perineural hæmorrhage. This compresses the nerve for a time, but on its absorption recovery takes place. Operation in these cases is not required, recovery takes place in from two to six months.

(*B*) *Lesions of Nerves which give rise to Interruption of Function with Incomplete Recovery.*—The following pathological conditions often give rise to incomplete recovery when not subjected to operation :—

(1) Concussion of the nerve with perineural suppuration which gives rise to the formation of fibrous tissue.

(2) Partial neuromata which probably result from endoneural hæmorrhage.

(3) Laceration of the nerve sheath with adhesions to the surrounding structure.

(1) Concussion of the nerve with suppuration in the surrounding tissue often gives rise to incomplete recovery, and this is extremely likely to happen when insufficient drainage of the wound has been established. Excessive formation of fibrous tissue takes place, and the nerve is partially compressed by its development.

(2) The development of partial neuromata is a condition which probably results from endoneural hæmorrhage. The condition is recognized by feeling a hard fibrous nodule, situated in a nerve which has been subjected to injury. Recovery in these cases may be incomplete, but the prognosis is good in those cases where there is only a partial loss of function. No attempt should be made to excise these swellings, when only a part of the nerve is affected, but the nerve should be placed in a bed of healthy tissue.

(3) Laceration of the nerve sheath with adhesions to the surrounding tissue. This condition is often associated with the signs and symptoms of an incomplete lesion, with evidence of nerve irritation. The condition

results from the nerve sheath having been torn by the injury, and inflammation following the injury gives rise to adhesions which bind the nerve down to the surrounding structures. An operation should be performed, and the nerve freed from adhesions, and placed in a bed of healthy tissue.

(*C*) *Lesions which Destroy Nerve Function* :—

(1) Complete division.

(2) Compression.

(3) The development of a complete neuroma without resolution, that is the development of fibrous tissue in the nerve prevents regeneration of the nerve taking place.

(1) *Complete Division.*—In many cases of injury the nerve is completely divided. The gap between the ends of the divided nerve varies much according to the severity of the injury, and the amount of tissue damaged. The cut ends of the nerve probably retract, and the gap is filled by a firm homogeneous mass of scar tissue. The amount of scar tissue depends upon the amount of suppuration. The greater the amount of suppuration, the greater the amount of scar tissue. The development of scar tissue as the result of suppuration, probably in all cases, forms a barrier, which prevents the nerve ends uniting without surgical aid. If the wound is aseptic, the ends of the divided nerve become united, and the conducting paths are re-established by a regeneration of nerve tissue (Thomson and Miles's "Manual of Surgery," vol. i.). This is not likely to happen, because when a nerve is divided its ends usually retract, even when the wound remains aseptic. But that it is possible is suggested by the following case :—

Case 1.—Injury to the left wrist, symptoms and signs of division of the ulnar nerve. Operation refused. Spontaneous recovery.

Private F. McN. was admitted to the Norfolk War Hospital on November 1, 1916. The patient stated that two months previously, September 1, 1916, he cut his wrist by falling on some barbed wire; the cut was a deep one, and he lost the sensation of the fourth finger, and the ulnar side of the third finger.

Condition on admission to the Norfolk War Hospital, November, 1916 : Examination of the left upper extremity, there was a healed wound at the upper border of the anterior annular ligament over the situation of the ulnar nerve. There was absolute loss of sensation over the area supplied by the ulnar nerve in the left hand. The muscles supplied by the ulnar nerve showed obvious signs of wasting. There was loss of power in the hand, and on electrical examination the muscles supplied by the ulnar nerve showed the reaction of degeneration. The diagnosis of division of the ulnar nerve was made, and operation advised. The patient refused operation. He was, therefore, treated with massage and electricity. The hand continued to waste, and showed the typical appearance of division of the ulnar nerve. At the end of four months, January, 1917, there was some improvement, and on examination of the healed wound a well-marked thickening could be felt in the course of the ulnar nerve; three weeks later

and twenty weeks from the date of the injury the patient stated that he thought he had some return of sensation in the hand. The condition of the hand was certainly improving.

At the proximal end of a divided nerve a terminal neuroma will develop. This bulbous end is firm, hard, and paler in colour than the normal nerve. It is composed of partly fibrous and partly nerve tissue. The development of a terminal neuroma is usually good evidence that the nerve has been divided. Its size and development appear to be dependent upon the condition of the surrounding tissues. Where there is much hard and dense fibrous tissue surrounding the ends of the divided nerve, the neuroma will be small and ill developed; when the tissues are lax and free, and where little fibrous tissue is present, it is probable that the terminal neuroma will be large and well developed. The upper extremity of the distal end is often shrunken, flattened, spread out, and difficult to define. The whole peripheral part of the divided nerve may be thin and wasted.

An operation is urgently needed in the case of a divided nerve. The ends should be brought together and united as soon as possible.

Closely allied to the terminal neuroma is a condition which may be described for convenience as a complete neuroma. This condition is occasionally met with as a result of a severe injury to a nerve. On careful observation of the nerve it is found that there is no break in its continuity, and that its course is interrupted by a hard spindle-like thickening. In other words, there is no firm homogeneous mass of scar tissue, such as is found separating the ends of a divided nerve, but that the nerve is continuous, except for the spindle-shaped swelling.

These cases require the most careful consideration in their treatment. If the complete neuroma is associated with loss of sensation which has been present for more than eight months, with progressive muscular wasting and contraction of the muscles, then the best treatment is to excise the swelling and bring the ends of the nerve into apposition. If, on the other hand, the signs and symptoms do not seem to be progressive, the muscular wasting is only slight and not progressive, and there are no contractions, then it is best to be content to place the injured nerve in a bed of healthy tissue, or to surround the seat of the lesion by a flap of fat.

In a paper on gunshot wound of peripheral nerves, Stockey writes thus: "The temptation to excise all hardened tissue about the nerve may lead one into greater difficulties and prolong convalescence. We know that nerve fibres will grow through considerable tissue resistance. If then, at operation this be borne in mind, and in place of free excision in suitable cases the nerve may be freed and wrapped in with a flap of fat or other suitable tissue, recovery is more rapid and more complete."

To sum up, partial neuromata require protection. Complete neuromata with progressive signs and symptoms require excision.

(2) *Compression.*—The chief causes giving rise to compression of nerve

are severe injury with marked suppuration in the course of the nerve. Compression is most likely to result in cases where there has been excessive suppuration with insufficient drainage. When a nerve lies in close relation to bone (for instance, the musculo-spiral in close relation to the humerus), the formation of callus, with the subsequent implication of the nerve, is a common cause of compression. These cases should be operated upon at the earliest possible moment. These are the most favourable cases, the prognosis being always good. The nerve at the site of compression will look a little thinner than the rest of the nerve. In appearance it will look a little whiter than the non-compressed part of the nerve, and on palpation it will feel somewhat dense and firm. Recovery in these cases is rapid after the compression has been relieved, and the damaged part of the nerve has been placed in a fresh bed or some soft tissué wrapped around it.

Time of Operation, Indication and Contra-indication for Operation.

Suture of nerves may be primary or secondary. Much has been written about primary and secondary suture for war wounds, which has been made possible by the aid of the Carrel-Dakin treatment, and by the use of bipp. Nothing or very little has been written about primary suture of nerves. In this series of cases there have been only two cases of primary suture. In one of these cases it was found necessary to again operate and perform secondary suture.

Cases.

Gunshot wound of the left forearm, resulting in laceration of the muscles and division of the ulnar nerve. Excision and repair of the wound, primary suture of ulnar nerve (March 9, 1917). Operation followed by marked suppuration and wound broke down. Secondary suture of ulnar nerve, August 30, 1917.

R. E. received a severe flesh wound of the left arm on March 9, 1917. An operation was done on the same day at a casualty clearing station. The wound was excised, repaired, and the ulnar nerve sutured. The wound broke down and suppuration was present for a considerable time. Eventually the wound healed. The patient was admitted to the Norfolk War Hospital on August 2, 1917, five months after being wounded. His condition on admission was as follows:—

Examination of the left upper extremity; there was loss of sensation over the area of the distribution of the ulnar nerve in the hand, the muscles supplied by the ulnar nerve also showed evidence of wasting. They do not react to electrical stimulation, the hand was weak, there were no broken lesions. The diagnosis of division of the ulnar nerve was made, and although primary suture had been done, it was considered this had been a failure, owing to the marked suppuration which followed the operation. On August 30, 1917, an operation was done, the ulnar nerve was explored,

and it was found united by about ½ inch of dense scar tissue. This was excised and the ends brought easily together without tension. There was no evidence of any nerve fibres passing through the piece of tissue removed. Since the operation progress has been satisfactory. There was little doubt that the primary suture made the operation of secondary suture a much easier operation in this case.

Case 3.—Gunshot wound of the right upper arm. Severe flesh. Drop wrist. Operation. Recovery.

P. P. was admitted to the Norfolk War Hospital on August 7, 1915. He had been wounded August 2. On examination there was a severe flesh wound of the right upper arm. There was marked septic infection of the wound. No injury of the bone was detected. There was wrist drop. An operation was performed on August 8, the wound was laid freely open, and the musculo-spiral nerve could be seen lying in the floor of the wound. It had been partially torn. One suture was put into the sheath of the nerve in order to draw the torn part of one nerve together. The patient recovered the power of his wrist after eight months, but there was still partial loss of power in the extensors of the second and third fingers.

On general principles it would seem useless to attempt primary suture of a divided nerve, but primary suture, when the nerve can be seen lying in a wound, with the hope of making any secondary suture at the proper time a much easier operation, is most desirable whenever possible. The results of secondary suture might be much more successful, although more difficult to perform, if a primary suture has been done in the first place. Secondary suture is accompanied with much more difficulty than primary suture, owing to the greater retraction of the nerve ends, their bulbous or filiform extremities being buried in scar tissue, or matted to the surrounding structures. These difficulties increase with time, so that provided there be no contra-indications, the operation should be done at the earliest possible moment. In the case of a completely divided nerve the recovery of the nerve cannot start until the operation has been performed. In cases of nerves being slowly strangulated by fibrous tissue or callus, the compression may cause irreparable damage both to the nerve itself and to the tissue it supplies. The earlier the operation the better the result in these cases. Early operation is indicated in cases of (1) complete division, (2) cases of compression, (3) cases of incomplete division where progress is arrested, (4) cases of nerve irritation, (5) cases of pain.

It has been said that a diagnosis cannot be made between anatomical and physiological division in cases of nerve injury. In many cases this is true, but from observations on this series of cases it would appear that if a nerve lesion has not shown any signs of recovery within three or four months from the time of the injury, some macroscopic pathological lesion will be found on exploration of the nerve. This rule has only failed twice in this series of cases.

When there has been no bony injury it is advisable that the wound

shall have been absolutely healed for at least one month before any operation is performed. When there has been a septic bony injury it is often advisable to wait three months after the wound has healed before operating on the nerve. Septic infection means failure in these operations. Most surgeons are in favour of early secondary suture of divided nerves for the following reasons: The earlier the operation is done after the wound is soundly healed the better are the anatomical relations maintained. The amount of scar tissue is smaller in amount, and softer in texture, so that it is more easily removed. If the nerve is not divided and only imbedded in scar tissue, valuable tissue has been saved by the operation, and perhaps irreparable damage prevented. The longer the operation is delayed the firmer are muscular contractions, and the greater the atrophy and degeneration of muscles, and the more likely are trophic lesions to occur in the skin, muscles, bones and joints.

There are two contra-indications to operation, namely:—

(1) The wound is not yet healed.

(2) There are progressive signs of recovery in the function of the nerve.

Some neurologists hold that if an early operation is advised, a positive diagnosis cannot be made, the nerve may yet recover. There is very little to be said in favour of waiting for a patient to get worse in order to make a positive and complete diagnosis. No surgeon waits for a malignant growth to produce secondary deposits in lymphatic glands, why wait for a divided nerve to produce degenerative changes in muscles and trophic lesions? If there are sufficient signs and symptoms to suggest that the nerve has suffered some macroscopic pathological lesion which is amenable to surgery, an operation should be performed.

Pre-operative and Post-operative Treatment.

The operative treatment in these cases should be looked upon merely as an incident in the treatment of the case. The most skilfully performed operation on an injured nerve is doomed to failure, and can accomplish little if the pre-operative and post-operative treatment is insufficient or neglected. The treatment in these cases should extend over a period of many months. The results can only be good when treatment is commenced early and is conducted with great perseverance both on the part of the patient and on the part of those who are responsible for his treatment. It is often difficult or impossible in these cases to prevent such complications and trophic lesions making their appearance, but if no attempt be made to prevent and overcome these conditions irreparable damage will supervene, damage which no amount of surgery can be expected to correct. It is most important to try and make the patient realize the importance of treatment, and to make him understand how much he can do for himself to promote his recovery.

The treatment can be considered under the following headings:—

(1) Postural treatment.

(2) Electro-therapeutic treatment, including electric treatment, massage and exercise.

Much has been written with regard to the positions which should be maintained after a patient has suffered a lesion of a peripheral nerve, but it must not be considered that everything has been done when the patient's hand or leg has been fixed in the orthodox position by some splint. It often happens that these cases are complicated by some injury to the bones of the limb. A splint is applied, fixing the whole limb. Of the many inventions for the treatment of fractures, and especially those complicated by nerve lesion, all are bad which hinder the easy movement of the phalanges of the thumb and fingers. If the hand or the foot are left fixed in any one position for long periods, and passive movements are not frequently performed, disaster is certain to follow. It is quite as important to remove a splint often as it is to apply it at all. The nutrition of the muscles must be preserved as much as possible by massage and electrical treatment. Vasomotor lesions are of common occurrence in these cases, and it is often noticed that the limb affected is cold and clammy. It is most important to keep these limbs warm, especially is warmth important when electrical stimulation is being used as a method of treatment. It is futile to apply electrical stimulation to cold and blue extremities. The limb should previously be wrapped in warm cotton wool, or immersed in hot water for a few minutes.

Joints must be prevented from getting stiff by passive movements, which should have been begun as early as possible. Cases of stiff joints will often be much benefited by hot-air baths.

The condition of the skin itself must not be neglected, but must be suitably protected from any injury. In short, every tissue enervated by the injured nerve must have due consideration and treatment. Treatment should be regular and continuous. If operative treatment becomes necessary massage should be again started as soon as possible, and in the upper extremity every attempt should be made to prevent stiffness and contraction of the hand and fingers occurring.

A position of relaxation should be maintained in all nerve injuries.

In median nerve injuries, the muscles supplied by the nerve are relaxed when the fingers and hand are flexed, and the thumb abducted and flexed, the arm being slightly rotated. Good results in this hospital have been obtained in cases of simple uncomplicated lesions of the median nerve without the application of splints.

In ulnar nerve injuries, the muscles supplied by the nerve are relaxed, when the fingers are spread apart; the first phalanges flexed, the second and third extended and the thumb abducted. Every attempt has been made to prevent contraction, and to maintain a position of relaxation in lesions of the ulnar nerve, by means of splints and appliances, but more success has been obtained by massage and passive movements, than has been obtained by methods of fixation.

In lesions of the musculo-spiral nerve, by means of a Jones's "cock-up" splint, or some modification of it, the hand is hyperextended, the thumb abducted, and the arm put in a position of supination, so relieving the extensor muscles of all strain. Operations on the musculo-spiral nerve are doomed to failure if the paralysed muscles are allowed to become over-stretched and lengthened by allowing the wrist to be in the flexed position of "drop" wrist. If the wrist is kept in good position injuries of the musculo-spiral nerve are among the most favourable for treatment.

It is useful before leaving the question of massage, electrical and postural treatment, to answer the question: What can these methods of treatment do for a patient who has suffered a nerve lesion, and how long should such treatment be continued? Massage, electrical and postural treatment can prevent joints becoming stiff. It can prevent muscular contraction to some degree, and it can maintain the tone of the muscles; in other words, it can enable the parts to be kept in the most favourable condition for the resumption of their functions.

It can do little in late and neglected cases. One often sees hopelessly contracted limbs with paralytic deformities, and with muscles the seat of degenerated changes, sent to the massage and electrical department as a last resource. These cases should have been sent to this department for the prevention of these calamities, not for their relief, for the best massage and electrical treatment is often almost a waste of time in these cases. It is difficult to lay down any definite rules and say how long treatment should be continued. Most cases show some improvement within six months. Massage and electrical treatment should be continued for at least six months after the operation on a nerve has been performed. It is unlikely that treatment for more than a year will give rise to much improvement.

Operation.—The operative procedure may be considered under the following headings:—

(1) The skin incision.

(2) The isolation of the nerve trunk above and below the site of the lesion.

(3) The freeing of the nerve at the actual site of the lesion.

(4) Passing the sutures, and the exact co-aptation of the ends of the divided nerve.

(5) The formation of a sheath at the site of the lesion.

(6) Suture of the deep fascia and closure of the wound.

An operation having been decided upon, it should be performed under general anæsthetic. The whole arm or leg to be operated upon should have been previously prepared with the utmost care, any lesion of the skin being an absolute contra-indication to the operation. It is a great advantage to have a third assistant, whose only duty it is to control the position of the arm or leg, and hold it in any desired position. This is especially advantageous when operating upon such nerves as the musculo-

spiral. The operation is best performed without the application of an Esmarch bandage. Any hæmorrhage which may occur is easily controlled by the application of forceps, and the wound, when closed, is left dry, there being much less risk of the development of any hæmatoma, a very undesirable complication. The skin incision should be of ample length; for instance, in operating on the ulnar nerve in the forearm, it is best to make an incision from just below the elbow to just above the wrist; the skin having been divided its edges are protected by thin rubber sheeting or gauze attached by means of clips. If possible, the skin incision should be planned so that it avoids the old scar, or the scar should be excised. Excision or freeing the scar should always be practised wherever possible; the deep fascia is next divided, and any bleeding points controlled.

The nerve trunk is sought above and below the point of severance, and it is traced downwards and upwards to the lesion. In doing this the tissue surrounding the nerve should be dissected away from the nerve, and the nerve itself should be handled as little as possible. On exposure of the injured part of the nerve a bridge of fibrous tissue is usually found joining the ends together; it is best to dissect this quite free before attempting to determine whether the nerve has been divided or not, so that when the nerve has been completely freed its continuity has not been divided during the operation. The fibrous tissue is then dissected off the nerve, and a decision arrived at as to the pathological condition present. When the conclusion is arrived at that the nerve has suffered anatomical division, and its ends are only joined by a fibrous band, one very fine silk suture is passed vertically through healthy parts of the upper and lower ends of the nerve to be joined. This suture is a great aid in maintaining the exact co-aptation of the nerve when suturing it after removal of the intermediate fibrous tissue. Different bundles of the nerve have different functions, so it is most important to bring the corresponding bundles together in the suturing. The nerve at the site of the suture should be handled as little as possible. After the primary suture has been passed, the supposed fibrous band is divided, and sections are cut from its distal and proximal ends until nerve fibres are seen. The primary suture is then tied, bringing the ends of the nerve into exact apposition; a series of sutures unite the nerve sheath. It is most important to avoid tension.

I use the finest silk and the finest needles for suturing the ends of divided nerves. Catgut is the material usually recommended. It appears to me that the exactness and security of the junction is more important than the suture material used to perform and make it. The necessity of the formation of a sheath at the site of junction has next to be considered. The nerve, after suture, should be placed in a bed of healthy tissue; if this can be done, it will not be necessary to surround it with any foreign tissue.

Much has been written with regard to the surrounding of sutured nerves with some material supposed to have protective virtues—a piece of

fat, a piece of vein, cargile membrane, a piece of peritoneum from a hernial sac, have all been recommended. A piece of fat of moderate thickness cut from the patient's own thigh, and loosely sutured round the nerve so as to protect the site of suture, makes an ideal covering and bed when much scar tissue is present. If the operation is done aseptically the procedure has everything to recommend it. It is advised by many surgeons, and condemned by others, but the researches of Bittrolp appear to prove that it is a sound and scientific procedure. It is doubtful if the aseptic introduction of a piece of the patient's own fat can ever be harmful, it is almost certain that it is often of great service. On completion of the suture any bleeding points are carefully tied with catgut, and the wound thoroughly irrigated with warm saline solution. The deep fascia is carefully sutured with catgut and the wound closed without drainage. The arm or leg is then carefully bandaged. The limb should be placed in the best position to relieve the nerves from tension, and it should be fixed in such a position by splints and bandages. Massage for the hand should be started two or three days after the operation.

Complications.—The chief complications met with in this series of cases have been :—

(1) Those due to septic infection of the wounds, extensive destruction of the soft parts and severe injuries to the bones.

(2) Extensive destruction to the nerve, resulting in a gap in its continuity, making end-to-end suture impossible.

(3) Drainage and rest for the inflamed parts have been relied on chiefly to overcome the septic complications. With thorough drainage the wounds have usually healed well, and given rise to little trouble. In a certain number of cases of severe infection, associated with marked swelling and œdema of the limb, it has occasionally happened that owing to the pain it has been impossible to prevent some stiffness of the fingers, due probably to the inflammation spreading to the tendon sheath. In such cases, after all the signs of inflammation have disappeared it will be found that much benefit will be derived from gentle but firm movements of the parts under an anæsthetic. The following case illustrates how much good can occasionally be done by gentle movements under an anæsthetic.

Case 4.—Gunshot wound of the right arm. Compound fracture of the radius. Division of the ulnar nerve. Operation. Secondary suture of the ulnar nerve, followed by stiffness of the fingers. Anæsthetic—movement of fingers. Improvement.

J. G. was admitted to the Norfolk War Hospital on May 8, 1917. On examination of the right upper extremity he was found to be suffering from a compound fracture of the right radius, and an injury to the ulnar nerve. On June 19, 1917, an operation was done, the ulnar nerve explored, and found to have been divided. The divided ends were dissected from scar tissue, the ends refreshed and united. The operation was not followed

by any marked improvement. In January, 1918, in spite of daily massage and electrical treatment, the fingers of the right hand had become stiff and almost motionless; any attempt to move them apparently caused great pain. In February, 1918, an anæsthetic was given, and the fingers gently but forcibly moved. This was followed by marked improvement in the movements of the hand and fingers, and on leaving the hospital in March, 1918, the patient possessed a moderately useful hand.

In cases associated with compound fractures, very careful treatment is necessary if necrosis with the development of a persistent sinus is to be avoided, which may delay the suture of the nerve for many months. These cases should be thoroughly drained at the earliest possible date, and all loose pieces of bone which have not firm attachment to periosteum removed. A healed wound must be obtained at the earliest possible time in cases of compound fracture complicated by nerve lesions. Carrel-Dakin treatment or continuous irrigation should be used as a method of treatment when necessary.

(2) Extensive destruction of the nerve, resulting in a gap in its continuity, making end-to-end suture impossible.

End-to-end suture is the operation of choice. It should be done whenever possible. It will usually be found possible to perform end-to-end suture after considerable pieces of nerve have been destroyed, if sufficient attention be paid to the following points: (1) The incision should be of ample length, so that the nerve may be separated from the surrounding structure, both above and below the lesion; (2) in lesions of the ulnar nerve, it can be displaced in front of the internal condyle of the humerus; (3) during and after the operation the position of the limb should be put in that of maximum relaxation so that all tension is taken off the nerve.

When it has been found impossible to perform end-to-end suture, a variety of procedures have been attempted and advised, but it would appear that up to the present time authorities have not been able to determine the values of these operations, but from various writings it would seem that their value is not great, and that for a few successes there are many failures. Some of the procedures would, on general principles, seem quite useless. The operation for uniting the ends of nerves by cutting flaps has been condemned as useless, but that this method is sometimes followed by success is illustrated by the following case:—

Case 5.—Gunshot wound of left forearm. Compound fracture of left radius. Injury to the ulnar nerve, June, 1915. Operation August, 1915. Exploration of the ulnar nerve and suture by means of turned-down flap from the upper end of the nerve to bridge a gap between the divided end. Recovery.

Lance-Cpl. B. B. was admitted to the Norfolk War Hospital in June, 1915. On examination of the left upper extremity he was found to be

suffering from a compound fracture of the left radius, together with an injury to the ulnar nerve.

The wound healed well, but there was no improvement in the condition of the parts supplied by the ulnar nerve. On August 30, 1915, an operation was performed. The ulnar nerve was exposed in the forearm. It was found to have been completely divided, and a large segment of the nerve had been completely destroyed. When the divided ends had been dissected free they could not be brought together. A flap was turned down from the upper end of the nerve in order to bridge the gap; union was then made with very fine silk. Slow improvement followed the operation. The patient had been seen on several occasions since the operation. He was examined in February, 1918, two and a half years after the operation. There was some return of sensation in the area of distribution of the ulnar nerve. There were slight contractions of the third and fourth fingers, but the hand was an extremely good one. He was still in the Army, and expected to be passed fit for general service at the next Medical Board.

Under certain circumstances nerve suture may be replaced by tendon transplantation, namely: (1) When nerve suture is impossible; (2) when the functional result attained by nerve suture is unsatisfactory. The most favourable cases in which to prepare tendon transplantation are those of injury to the musculo-spiral and posterior interosseous nerves. The transplantation of the tendon of the flexor carpi radialis through and into the tendons of the extensor longus pollicis, the extensor brevis pollicis, and the extensors of the fingers is an operation followed by such good results that it should always be done in cases when it is considered likely that the musculo-spiral nerve will not recover. "Complete restoration of function may be expected in four weeks, an enormous saving of time compared with the year which must elapse before recovery after nerve suture."—(Murphy).

Prognosis and Results.—The prognosis depends upon the variety and severity of the injury and the complications present. Cases of physiological division usually do well, and often recover completely in from three to six months. Cases of compression require prolonged and skilful treatment if they are to do well, recovery is often incomplete, but good results are often obtained, and the disability usually is not great. The prognosis in cases of complete division is always grave, especially if complications are present. Great patience is required in the treatment of these cases. It is doubtful if complete and perfect recovery ever results from a divided nerve, but that much can be done to produce good functional results is undoubted. The time taken for recovery is often long and progress slow, but some cases continue to improve for two or three years after the operation of suture of the nerve has been skilfully performed. It is difficult to follow up cases for a long period of time. A few cases in this series have been observed for as long as two and a half years, the results have been grati-

fying in these cases which have been observed for a long period. The average duration of observation after the operation has been over eight months. This is too short a time to obtain the final results, but it is long enough to form some estimate as to what they are likely to be.

In attempting to sum up the results a careful record has been taken of the patients' condition on their discharge from hospital. Letters have been sent to the patients, and questions have been asked with regard to their progress and present condition. Many replies have been received. An attempt has been made to classify the results into one of the following groups :—

(1) Perfect recovery; (2) very good recovery; (3) good recovery; (4) moderate recovery; (5) bad recovery: (6) very bad recovery. Opinions, no doubt, would differ as to which ought to be considered a good and which a bad result; the patient's opinion with regard to the result has been allowed to have full weight, and the severity of the primary lesion has also been taken into consideration. No case of (1) "perfect recovery" has been obtained. If the patient can follow any occupation and has little disability the result has been considered to be (2) "very good." The result has been considered to be (3) "good" if the patient has been retained in the Army and classified into a group, or has showed signs of commencing recovery within six months from the date of operation. (4) "Moderate" results are those in which the limb is considered to be much better than an artificial one, but the disability is nevertheless considerable. (5) "Bad" results are those in which the limb is of very little use, but is still as good or better than an artificial limb. (6) "Very bad" results are those in which the limb is practically useless, and are the cases in which amputation must be considered.

Tables have been drawn up showing the number of cases operated upon. The various nerve lesions have been classified in a tabular form, and an attempt made to show the results obtained up to the present time. From a study of these cases the following are the conclusions arrived at:—

(1) That the diagnosis of an injury to a peripheral nerve ought to be made at the earliest possible time.

(2) Successful recovery depends upon early, correct, and continuous treatment.

(3) Primary suture should be considered and practised whenever possible.

(4) That there should be no unnecessary delay in exploring a nerve if there is sufficient evidence that it has received some injury resulting in a macroscopic pathological lesion.

(5) It is almost certain that some macroscopical lesion is present in cases which show no signs of recovery after four months' treatment.

(6) That operations on injured nerves should only be done in well-

Complete Lesion of the Ulnar Nerve. Operation required: End-to-end Suture.

No. of case	Name	Length of time between reception of wound and operation	Period of observation since operation	Complications	Presence of muscular wasting	Presence of return of sensation	Presence of muscular contraction	Presence of trophic lesion (ulceration)	Result considered to be	Remarks
1	A. S.	6 months	12 months	—	—	—	—	—	Good	Returned to duty. Killed
2	E. J.	5 "	18 "	—	Yes	No	Yes	No	Bad	—
3	F. H.	2 "	18 "	—	"	"	Slight	"	Moderate	Electrician's labourer
4	A. D.	3 "	9 "	—	Slight	Yes	No	"	Good	Sensation and power returning at end of eight months. A very good hand
5	J. R.	3 "	6 "	—	"	No	Slight	"	Moderate	—
6	J. H.	12 "	14 "	—	Yes	"	Yes	"	"	—
7	A. W.	3 "	14 "	—	"	"	No	"	"	Can do light work
8	A. S.	4 "	12 "	—	"	"	Yes	"	"	—
9	A. D.	11 "	8 "	—	Slight	Yes	Slight	"	Good	Work—fixing woodwork
10	E. J.	3 "	12 "	—	"	No	No	"	Bad	—
11	J. G.	2 "	9 "	Fractured ulna	"	Slight	Slight	"	Moderate	—
12	T. E. R.	3 "	9 "	—	"	Yes; slight	"	"	"	Passed B 2
13	F. J.	3 "	6 "	—	"	No	"	"	Good	—
14	H. C. J.	4 "	9 "	Fractured radius	"	"	"	"	"	—
15	A. M. D.	7 "	8 "	Fractured metacarpal	Yes	"	Yes	"	Bad	—
16	E. R.	5 "	8 "	—	"	"	"	"	Good	—
17	H. K.	3 "	7 "	—	Slight	Slight	No	"	"	—
18	J. C.	5 "	7 "	—	"	No	Slight	"	"	—
19	S. M.	3 "	6 "	—	"	"	"	"	"	—
20	W. M.	7 "	7 "	—	Yes	"	Yes	"	Very bad	—
21	S. M.	6 "	6 "	—	"	"	"	"	Good	—
22	H. L.	6 "	5 "	Fractured ulna	"	"	"	"	Moderate	—

Complete Lesion of the Ulnar Nerve. Suture by Flap Method.

23	L. B.	3 months	30 months	Fractured radius	Slight	Yes	Slight	No	Very good	—

LESIONS OF THE ULNAR NERVE. CASES OF COMPRESSION, ETC.

1	C. E.	6 months	24 months	Fractured ulna	Slight	Slight	Yes	No	Moderate	—
2	S. A.	4 ,,	24 ,,	Fractured ulna	,,	No	Slight	,,	,,	—
3	C. C.	12 ,,	15 ,,	None	,,	,,	,,	,,	Good	A very useful hand.
4	A. C.	3 ,,	15 ,,	,,	,,	Slight	No	,,	Moderate	Fingers rather stiff.
5	F. B.	3 ,,	6 ,,	,,	,,	No	,,	,,	Good	Hand weak but improving.
6	C. W.	6 ,,	4 ,,	,,	,,	,,	Slight	,,	,,	—
7	S. P.	3 ,,	18 ,,	Fractured radius	Yes	Slight	No	,,	,,	—
8	S. R.	1 month	4 ,,	—	—	—	—	—	—	Satisfactory result on discharge from hospital. Cannot be traced.
9	R. L.	2 months	4 ,,	—	—	—	—	—	—	Ditto. Ditto.
10	J. C.	3 ,,	4 ,,	—	Slight	No	No	,,	Moderate	—
11	C. C.	2 ,,	4 ,,	—	,,	,,	,,	,,	,,	—
12	R. T.	2 ,,	12 ,,	—	,,	Yes	,,	,,	Good	—

LESIONS OF THE MEDIAN NERVE. CASES OF DIVISION—SUTURE.

1	G. C. K.	8 ,,	12 months	Fractured radius	Yes	Slight	No	Yes	Good	A very useful hand on discharge from hospital.
2	S. S.	1 month	6 ,,	None	No	Yes	,,	No	,,	—
3	S. W.	3 months	9 ,,	,,	,,	,,	,,	,,	,,	—
4	C. B.	3 ,,	9 ,,	,,	,,	Slight	,,	,,	,,	—
5	J. W.	2 ,,	6 ,,	,,	Slight	No	,,	,,	Moderate	Improving.
6	S. W.	3 ,,	4 ,,	,,	,,	,,	,,	,,	,,	,,
7	H. H.	14 ,,	10 ,,	Severe injury to tendons	Yes	,,	Yes	,,	Bad	—

LESIONS OF THE MEDIAN NERVE—CASES OF COMPRESSION, ETC.

1	P. H.	1 month	2 months	None	No	Yes	No	No	Good	—
2	C. G.	2 months	12 ,,	,,	,,	,,	,,	,,	,,	—
3	J. J.	5 ,,	6 ,,	,,	,,	No	Yes	,,	Moderate	—
4	F. S.	5 ,,	4 ,,	Aneurysm of brachial artery; injury to elbow joint	,,	,,	,,	Yes	,,	—
5	F. S.	6 ,,	5 ,,	None	Yes	,,	,,	No	,,	—
6	J. B.	4 ,,	5 ,,	,,	No	Yes	No	,,	Good	—
7	W. J.	14 ,,	4 ,,	Fractured humerus	Yes	No	,,	,,	Moderate	—

LESION OF MUSCULO-SPIRAL NERVE. CASES OF DIVISION. OPERATION, SUTURE.

No. of case	Name	Length of time between reception of wound and operation	Length of time of observation after operation	Complications	Presence of muscular wasting	Presence of drop wrist	Presence of muscular contraction	Result considered to be	Remarks
1	J. H. ..	4 months	14 months	Secondary hæmorrhage from superior profunda artery	Yes ..	Recovered	No ..	Good ..	Hand still weak
2	J. R. ..	3 ,,	12 ,,	None	Slight ..	,,	,, ..	,, ..	Extensors still weak
3	R. T. ..	5 ,,	6 ,,	Fractured humerus ..	,, ..	Recovering	,, ..	Moderate..	—
4	J. W. ..	2 ,,	4 ,,	—	Yes ..	Yes ..	,, ..	—	Good condition on leaving hospital. Unable to trace
5	P. S. ..	8 ,,	8 ,,	Fractured humerus ..	,, ..	,, ..	,, ..	Moderate..	—
6	W. L. ..	2 ,,	6 ,,	—	Slight ..	Recovering	,, ..	Good ..	—
7	F. F. ..	4 ,,	10 ,,	Fractured humerus ..	Yes ..	Yes ..	,, ..	Moderate..	—
8	M. M. ..	4 ,,	8 ,,	,, ,, ..	,, ..	,, ..	,, ..	,, ..	—

LESION OF THE MUSCOLO-SPIRAL NERVE. CASES OF COMPRESSION, ETC.

No. of case	Name	Length of time between reception of wound and operation	Length of time of observation after operation	Complications	Presence of muscular wasting	Presence of drop wrist	Presence of muscular contraction	Result considered to be	Remarks
1	B. B. ..	2 weeks..	4 months	—	Slight ..	Recovered	No ..	Good ..	—
2	F. W. ..	3 months	6 ,,	—	,, ..	,,	,, ..	,, ..	—
3	F. J. ..	2 ,,	6 ,,	—	,, ..	,,	,, ..	,, ..	—
4	P. C. ..	4 ,,	4 ,,	—	—	—	—	—	Fair condition on leaving hospital. Not able to trace
5	A. C. ..	6 ,,	6 ,,	Fractured humerus ..	Yes ..	Recovered	No ..	Good ..	—
6	F. S. ..	3 ,,	9 ,,	,, ,, ..	,, ..	Yes ..	,, ..	Moderate..	—
7	T. W. ..	4 ,,	4 ,,	Fractured humerus; slight extensor tendons	,, ..	,, ..	,, ..	Bad ..	—
8	M. C. ..	5 ,,	4 ,,	Fractured humerus ..	—	—	—	—	Fair condition on leaving hospital. Not able to trace.
9	B. B. ..	8 ,,	8 ,,	,, ,, ..	Yes ..	Recovered	No ..	Moderate..	—

Complete Lesion of the External Popliteal Nerve. Operation: Suture.

No. of case	Name	Length of time between reception of wound and operation	Length of time of observation after operation	Complications	Presence of muscular wasting	Presence of return of sensation	Presence of muscular contraction	Recovery from drop-foot	Result considered to be	Remarks
1	B. B.	14 months	8 months	None	Slight	No	No	No	Moderate	—
2	G. N.	3 ,,	6 ,,	,,	,,	,,	,,	,,	,,	—
				Lesion of the External Popliteal Nerve. Cases of Compression, etc.						
1	P. C.	3 months	15 months	None	None	Yes	No	Yes	Very good	Returned to active service.
2	T. G. N.	5 ,,	6 ,,	,,	Slight	,,	,,	,,	Good	—
3	E. W.	3 ,,	8 ,,	,,	None	No	,,	,,	,,	—
4	D. S. S.	7 ,,	6 ,,	Severe flesh wound	Yes	,,	Slight	No	Moderate	—

Complete Lesion of the Ulnar and Median Nerves. Operation: End-to-end Suture.

No. of case	Name	Length of time between reception of wound and operation	Period of observation since operation	Complications	Presence of muscular wasting	Presence of return of sensation	Presence of muscular contraction	Presence of trophic lesion (muscular)	Result to be considered
1	N. C.	12 months	12 months	Severe flesh wound	Yes	No	Yes	No	Bad
2	C. H.	4 ,,	16 ,,	None	,,	,,	,,	,,	,,
3	B. B.	6 ,,	8 ,,	—	,,	Slight	No	Yes; re-covering	Good
	Incomplete Lesions of the Ulnar and Median Nerves. Compression.								
	H. R.	4 months	6 months	None	Yes	No	Slight	No	Moderate
	Miscellaneous Lesions.								
	Nerve Lesions								
1	L. I. Division of post-tibial	8 months	14 months	None	Yes	Slight	Slight	No	Moderate
2	L. J. Division of sciatic	6 ,,	15 ,,	Very severe flesh wound	,,	,,	No	,,	Good
3	G. G. Internal popliteal caught in scar tissues	2 ,,	9 ,,	—	No	Yes	,,	,,	,,

Table of Results of Lesion of the Ulnar and Median, Musculo-Spiral, and External Popliteal Nerves.

Results	Ulnar		Median		Musculo-spiral		External popliteal		Combined lesions: median and ulnar		Total		Grand total
	Complete lesion	Incomplete lesion	Complete lesion	Incomplete lesion	Complete lesion	Incomplete lesion	Complete lesion	Incomplete lesion	Complete lesion	Incomplete lesion	Complete lesion	Incomplete lesion	
Perfect.. ..	—	—	—	—	—	—	—	—	—	—	0	0	0
Very good ..	1	—	—	—	—	—	—	1	—	—	1	1	2
Good	10	5	4	3	4	4	—	2	1	—	19	14	33
Moderate ..	8	5	2	4	4	2	2	1	—	1	16	13	29
Bad	3	—	1	—	—	1	—	—	2	—	6	1	7
Very bad ..	1	—	—	—	—	—	—	—	—	—	1	0	1
—	—	2	—	—	—	2	—	—	—	—	0	4	4
Total ..	23	12	7	7	8	9	2	4	3	1	—	—	76

equipped general hospitals, and by those surgeons who have ample experience of such cases.

(7) That sufficient attention is not usually paid to the early pre-operative and post-operative treatment in paralytic deformities, and shortened muscles are often the result of ignorance and neglect.

(8) That the extreme gravity of an injury to a peripheral nerve is not sufficiently realized by the general profession.

I wish to acknowledge my indebtedness and appreciation to Colonel T. H. Openshaw, Consulting Surgeon to the Eastern Command, for his advice in some of the more difficult cases, and I also desire to thank Major Cleveland and his staff in the electro-therapeutic department of the hospital for numerous suggestions in the treatment of the cases.

The following table shows the total number of nerve lesions which have come under observation, and their relative frequency.

Ulnar	89
Median	51
Musculo-spiral and post-interosseous	50
External popliteal	30
Lesions of the brachial plexes	9
Combined lesions to the median and ulnar	8
Anterior tibial	4
Circumflex	2
Internal popliteal	2
Posterior tibial	2
Sciatic	2
Anterior crunal	1
	250

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THE PROPHYLAXIS OF MALARIA.

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PART I.

By Colonel G. T. RAWNSLEY.

In the *Practitioner* for the month of October, 1917, the interesting statement appears that Mitzmain[1] has carried out an important investigation for the United States Public Health Service on the problem whether the mosquito or man is the winter carrier of the malaria parasite. Amongst his conclusions are:—

(1) Only the adult female mosquito of anopheles hibernates.

(2) Anophelines were found negative for malarial parasites in winter.

(3) Man was largely infected with the malaria parasite and about one-fourth (24·8 per cent) of the human carriers harboured gametocytes.

(4) Three infected *Anopheles quadrimaculatus* were found in the houses of gametocyte carriers during May 15 to 26; previously thereto 1,180 specimens were negative.

The conclusion was thus arrived at that man is the sole winter carrier.

So far no other forms of animal life, except man and the anopheline mosquito, have been found by investigators to be carriers of the malaria parasite.

If we admit the accuracy of these statements, the lines indicated for the prophylaxis of malaria resolve themselves into the destruction of the parasite in man and the destruction of the female anopheline mosquito which alone with man is a harbourer of the malarial parasite.

It would appear therefore the best way to attain this end, as far as man is concerned, is by carrying out the necessary treatment, in a country where there is a malarial and a non-malarial season, in the winter months. The reasons which lend support to this view are:—

(1) There is a smaller incidence of malaria, primary cases being absent.

(2) Reinfections are non-existent owing to inactivity of the mosquito.

(3) If the major part of the population can be freed from the parasite, when the next malarial season starts fewer carriers of infection are present. If the treatment is begun sufficiently early relapses will indicate

[1] Mitzmain. Public Health *Bulletin*, No. 84, 1916 (Treasury Department, U.S.A. Public Health Service).

who are carriers and who are not, and it should be easy in an army to remove those who are a source of danger by sending them out of the country before the onset of the summer and the period of renewed mosquito activity.

The prophylactic measures adopted in this army were as follows:—

(1) *In 1916*:—

(*a*) Prophylactic quinine was given in five-grain doses twice weekly, usually on two consecutive days. It was quite useless to prevent a very high occurrence of malarial fever.

(*b*) Pieces of netting about one yard square were used to cover the face, but not being mosquito-proof were naturally ineffectual. Subsequently the size was increased to six feet by four feet, and in places where they could be used hospital pattern nets were issued.

(2) *In 1917*:—

(*a*) Prophylactic quinine has been given in varying doses: ten grains twice weekly on Thursdays and Sundays, every other day, four days weekly and every day. In fifteen-grain doses daily and in twenty-grain doses daily. These doses have all failed to confer prophylaxis, in fact, I look upon the larger doses as positively dangerous. The smaller dose probably does not as a rule check pyrexia, and so the man reports sick for fever, his disease is recognized and he comes early under effective treatment; but the larger amounts, that is a dosage of over and above ten grains twice weekly, have in my experience in a very large number of cases fulfilled the anti-pyretic action of the drug without destroying the malarial parasite. In many regiments treated in this way we were lulled into a sense of false security by the absence of pyrexia and later on many men who had never reported sick were found with enlarged spleens, anæmia, palpitation and all the symptoms of malarial cachexia. Thus by these methods the men became a source of danger in spreading infection, and the quinine instead of having a prophylactic effect had exactly the opposite, as it failed to destroy the parasite, and so the man became a gametocyte carrier capable of infecting mosquitoes. Many of the units treated with doses of quinine over ten grains twice weekly were the worst sufferers from malaria this year. I do not consider such doses have any effect on making the parasite quinine-resistant, but my experience is that the strength of the quinine solution in the blood is not sufficient in the doses aforementioned to destroy the parasite. Later on in this paper I shall give further reasons for this opinion.

(*b*) A bivouac mosquito net was used. This certainly afforded large protection and was an undoubted factor in the prevention of malaria. An improved type is being adopted for 1918.

(*c*) Head net veils and gloves for men on night duty. These were not popular; men complained of difficulty in seeing and of handling their arms and in many cases they were discarded.

(*d*) Repellant ointment is undoubtedly useful if it is replaced very frequently during the hours men are exposed on night duty.

(*e*) Other anti-malarial measures having for their object the destruction of the mosquito.

In 1916, owing to the advanced state of the season, when we took over our present front little was done in this respect, but this year extensive drainage, canalization, oiling, clearing of brushwood, scrub and rank vegetation and burning of grass, etc., in the vicinity of camps, have been carried out with undoubtedly good results.

(*f*) Pitching camps on as high ground as possible and away from known malarial sites.

The result of these methods is shown by a comparison of the average daily sick rates for all causes per month as under for the same two Divisions. Malaria practically only affects these rates :—

	1916	1917
May	0·20	0·24
June	0·31	0·28
July	0·58	0·50
August	0·46	0·42
September	0·75	0·55
October	0·47	0·54
November	0·25	0·34

The slightly higher rates for October and November, 1917, are due to the fact that in 1916 all malarial cases were evacuated from the country, whereas in 1917 they have been treated here, therefore these rates include a higher proportion of relapses. But satisfactory as these results are it appeared to me that more might be done, and with this end in view I considered the advisability of putting troops on a much higher dose of daily quinine, viz., thirty grains daily. Captain D. Thomson, R.A.M.C., in his paper in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS stated this should be given in hospital, keeping the man in bed the first week, up in the ward the second week, and taking gentle exercise out of doors during the third week. But hospital treatment except for men with high temperatures or otherwise needing admission would not be feasible in the case of large numbers of men suffering from chronic malaria in an army in the field. I therefore received permission to start a small camp for 100 men; these men were under ordinary conditions except that they performed no large amount of work. They went for walks and did all the fatigues of their camp. The treatment given was thirty grains of quinine in mixture daily as follows :—

℞ Quinine sulphas	10 gr.	or,	Quinine bihydrochlor.	10 gr.
Aquæ	ad 1 oz.		Acid hydrochlor. dil.	q.s.
Acid sulph. dil.	q.s.		Aquæ	ad 1 oz.

Thrice daily, further well diluted with water, within five minutes of each meal, i.e., breakfast, dinner and tea. An iron, arsenic and quinine tabloid was also given at the same time, the composition of which is :—

℞ Iron hypophosphite	2 gr.
Acid, arsenious, B.P.	$\frac{1}{50}$,,
Quinine bisulphate	1 ,,
Strychnine sulphate	$\frac{1}{50}$,,
Saccharine, B.P.	$\frac{1}{100}$,,

The clinical results were rapid and exceeded all expectations, there were no untoward symptoms, such as deafness, altered vision, etc., and from the rapid disappearance of anæmia and the healthy colour which appeared in its place, it was easy to pick out new arrivals from those who had been some few days in camp. Even after five days the improvement was marked.

Being satisfied with the success of this treatment and that it had no ill effects on the men, it was resolved to continue treatment in other cases and under different conditions; in the one instance fifty-one men who were known to be badly infected with malaria were camped near a casualty clearing station and kept as nearly as possible under service conditions, doing route marches and fatigues, and about the same amount of work as they would have done in the front line. They lived in bivouac tents with mosquito nets, and during a great part of their stay the weather was very variable, being wet with cold winds, conditions which should have been favourable to chill and consequent malarial relapse. While here advantage was taken of the proximity of a Bacteriological Laboratory and an Ophthalmic Centre, for the purpose of carrying out observations appertaining to the state of the blood and the condition of their eyes.

Two medical officers, Captain W. H. Peacock, R.A.M.C., and Captain T. H. Comerford, R.A.M.C., gave most valuable assistance in closely watching and supervising the progress of treatment. No unfavourable symptoms were observed in any of these men by either of these officers, nor by myself as the result of frequent inspections. No defects of vision or hearing were observed. Anæmia soon vanished, the hæmoglobin rose in the blood and parasites disappeared microscopically, the spleen went down in size and the men became robust, vigorous and active. Nearly all the men increased largely in weight and previous results were confirmed. These fifty-one men were given no quinine for first few days of their stay at the casualty clearing station before treatment was commenced and fifteen of the number suffered from relapses of malarial fever and in many the parasite was found in their blood during this time. They took bihydrochloride of quinine.

In the other instance a company of a battalion was placed, at my request, on the same treatment by Lieutenant-Colonel R. A. Cunningham, R.A.M.C., whose report is added (Part II). This company remained doing full duty in the trenches, and subsequently, at the expiration of their tour there, in the support line. They took the treatment as will be seen without any unfavourable symptoms, but on the contrary with marked and beneficial results.

Two men out of the original fifty-one of the first observation had to remain on under treatment; one man still had the malignant parasite in his blood, but after a further period of treatment this had disappeared microscopically; the other man was suffering from an irregular atypical pyrexia, no parasite being found in his blood, but on the cessation of quinine

the malignant parasite was found in moderate numbers. No other man out of this number nor amongst the cases of the second observation treated by Lieutenant-Colonel Cunningham has so far had a relapse.

Allusion may now be made to the opinion previously expressed that smaller doses of quinine up to twenty grains do not make the parasite quinine-resistant. The result of the treatment of thirty-grain doses daily was followed by immediate, very rapid and marked improvement in men well dosed the whole season with quinine; the blood tests showed by the early disappearance of the parasite and the rapid rise in the hæmoglobin that no powers of quinine resistance had been conferred on the parasite when sufficient and effective doses of the drug were given, and one would not have expected to attain these results so speedily had such been the case, and the credit must be given to the production of such alterations in the blood to the activity of the drug.

The course of treatment recommended and which will be further observed is to put a company of a regiment at a time on thirty grains quinine daily for a period of twenty-four days. Men after four weeks begin to suffer from quinine intolerance.

Points to bear in mind are that the mixture should be well diluted in at least an ounce and a half of water, and administered *immediately* after a meal—the longer interval that elapses the more chance there is of intolerance to the drug. It should be given twice daily in fifteen-grain doses morning and evening; three minims of liquor arsenicalis hydrochloricus may be added to each dose, but Fowler's solution should not be used, as this preparation in an acid solution is liable to deposit the arsenic to the bottom of the bottle and a dangerous dose of arsenic may thus be given. The tablet of iron, arsenic and quinine is also a useful adjunct to treatment in place of the liquor arsenicalis hydrochloricus in the mixture. Another precaution is that the solution should be measured in a dispensing measure-glass, and tablespoons and other such measures not employed, as inaccuracy in dosage is bound to occur.

It has been found by Lieutenant-Colonel Cunningham, R.A.M.C., that healthy men stand this dosage as well as, if not better than, those suffering from malaria, and also in a further observation on my part; consequently the conclusion arrived at is that in very unhealthy portions of a line troops should only remain twelve days at the most and during this period should receive a daily dosage of thirty grains of quinine; this idea will be further developed during the next malarial season. Further, from a result of experience of two malarial seasons in Macedonia, my experience in West Africa, India and the West Indies is enhanced that:—

(1) Prophylactic quinine as now given is useless if not dangerous in the prevention of malaria, as it so frequently only masks the disease.

(2) That the proper prophylactic dose is one of thirty grains daily, but this cannot be given for a longer period than four weeks.

(3) That a smaller dosage of quinine does not render the parasite quinine-resistant.

(4) Prophylaxis should aim chiefly at destroying the mosquito and its larvæ, and protecting man from its bites, and when man becomes infected destroying the parasite by suitable doses of quinine, especially during the post-malarial season.

In the case of troops every officer and man who has been exposed to malarial infection should undergo a winter prophylactic course. In this connexion Colonel Sir M. P. C. Holt recently told me he had the blood examined of many men in this country with no record of malarial fever and found many of them infected with the parasite.

(5) The destruction of hibernating mosquitoes. The experience here so far is that only the female hibernates.

(6) Larvæ have also been found in the winter in Macedonia beneath the ice. Measures therefore for their destruction must also be taken.

Observations as to the effect of thirty grains of quinine daily on the blood of healthy men have also been made by Captain J. Warnock, R.A.M.C., and are included in his Report (Part III).

I am indebted to Captain H. E. Smith, R.A.M.C.(T)., for the following report on the condition of the eyes and the state of vision of the fifty-one men under observation at the casualty clearing station :—

"I have concluded the ophthalmic examination of the fifty-one post-malarial cases under special quinine treatment at the casualty clearing station. The cases were examined during the first and last weeks of the treatment, and the points investigated were :—

"(1) The visual acuity.

"(2) The white and colour fields.

"(3) Subjective symptoms, e.g., transient obscuration of vision.

"(4) Ophthalmoscopic examination: (*a*) colour of optic disc; (*b*) size of vessels; (*c*) any other abnormality.

"I have to report that there was no complaint of defective sight, no objective deterioration of visual acuity, and no evidence of change in the field or fundus in any of the cases."

One half of the men who had been treated both at the casualty clearing station and by Lieutenant-Colonel Cunningham have continued quinine in fifteen-grain doses daily, the other half have had no quinine.

The men from the casualty clearing station, with two exceptions, returned to duty with their regiments on November 15, 1917, four weeks ago. A few days before leaving, a team of eleven of these men played the casualty clearing station at football and won their match by 7 goals to 2; they played with vigour and showed no signs of distress during the game.

PART II.

By Lieutenant-Colonel R. A. CUNNINGHAM, R.A.M.C.

Malaria is an infective disease which is spread from one man to another by means of anopheline mosquitoes. Reducing the number of infected persons in a community is one of the methods of lowering the incidence of the disease. Owing to the absence of the civil population, infection in the front line area is chiefly derived from the troops themselves. If, therefore, it were possible to make a large proportion of the troops non-infective before the next malarial season begins, it would greatly assist in reducing the incidence of malaria.

With this object in view, Colonel G. T. Rawnsley, D.D.M.S., of the Corps, undertook a series of observations as to the effect of the administration of thirty grains of quinine daily for a period of from three to four weeks in permanently curing the disease, and so preventing the formation of carriers. If this treatment was to be applied as a practical measure to the whole Corps, it was necessary to prove that it could be carried out whilst the men were actually engaged in their ordinary duties with their units. At his request, therefore, I carried out a course of treatment in "X" Company, the most highly infected company in a badly infected battalion. Almost every man in the company had had malaria, and as it was impossible to say which men were or were not liable to relapses, all the men in the company who were present on October 10, 1917, with one or two exceptions, were put on the treatment. Each man received 30 grains quinine daily, 15 grains quinine sulph. in solution diluted to 1½ ounces being given every morning and evening after meals. During the second week two minims Fowler's solution were given with each dose, and during the fourth week three minims. As new drafts joined the company from hospital or elsewhere, they were also put on this treatment. The total number of men who received this treatment between October 10 and November 6 for at least three weeks was 104; of these eighty-eight received it for the full four weeks.

The following figures show the results of treatment:—

(1) Total number of men who had the treatment for at least three weeks 104

(2) Number of men who were sent to the Field Ambulance with fever between October 10 and November 6, whilst taking 30 grains quinine daily 2

These two men were sent to the Field Ambulance within the first few days after the treatment began.

(3) Number of men who were sent to the Field Ambulance with fever from the rest of the battalion (numbering about 500), between October 10 and November 6.. 80

The whole of these men had been on 10 grains daily for the last three months.

In addition to the men sent to hospital during this period, October 10 to November 6, a large number of men in the rest of the battalion had mild relapses, and were treated regimentally. Among the 104 men receiving the special treatment, only six had slight rises of temperature, and this was at the very beginning of the treatment. Three officers of

"X" Company who were not on the treatment had fever between October 10 and November 6.

From October 10 to 25 the men receiving the special treatment were in the front line, and were doing the ordinary work of the battalion—some digging, some on outpost, some wiring, etc. Two platoons were in a fort in the front line from October 14 to 25, and during this period no man in these two platoons had fever or was off duty, although each man was on outpost duty every other night, and the weather was frequently wet and cold.

On October 25 the company moved back to a camp in support, and although the day had been very wet, and the men had to bivouac on wet ground when they got to camp, no one took fever in consequence.

The men have improved very much in appearance and health, and have lost the anæmic look that they had. They are at present doing training, road making, route marching, etc., and play football with much vigour after the day's work. Many of them also took part in the regimental sports—running, jumping, tug-of-war, etc. They went back again into the front line on November 7.

During the course of treatment I saw the quinine administered, inspected every man morning and evening, felt his pulse, and inquired how he was.

In a very few cases I reduced the dose to twenty grains on account of slight buzzing and slight deafness, but it was not really necessary to have done so. In one or two cases I gave men tabloids instead of solution on account of slight indigestion. Two of the men towards the end of the fourth week of treatment complained of slight giddiness, and I stopped their quinine. Apart from these few cases all the men took the quinine without the slightest inconvenience, including fourteen men who had never had malaria.

The following are some details of the previous history of the 104 men who received the treatment:—

(1) Number who had been in hospital with malaria	46
(2) Number who had had fever, but were treated regimentally	44
(3) Number who had never had fever	14
Total	104

Details as to relapses in the ninety men who had had fever:—

(1) Number who had had numerous relapses previous to the commencement of the special treatment	6
(2) Number who had had two relapses	6
(3) Number who had had one relapse	25
(4) Number who had had no relapse	53
Total	90

The observation is being continued as follows:—

The administration of quinine to the fourteen men who never had malaria has been stopped.

As regards the remaining 90, 2 men have gone away, which leaves 88.

The administration of quinine to 44 of these has been stopped. The other 44 are to receive 15 grains quinine daily for one month, and then 10 grains daily for another month.

The number of relapses which occur in the first forty-four will be compared with the number occurring in the second forty-four.

A roll of the men has been made, and any case of fever which occurs among them, whether treated regimentally or admitted to field ambulance, is notified.

During the month of November seventy-two cases of malaria and N.Y.D. pyrexia were admitted to field ambulance from the rest of the battalion, and none from the men who underwent the treatment. One of the men had a slight rise of temperature on November 30, and he is being treated regimentally.

These results are exceedingly striking. In eight weeks there was practically no pyrexia among the 104 men of "X" Company, although this was the worst infected company in the battalion, while from the rest of the battalion, during the same period, nearly 150 men were admitted to hospital with malaria and N.Y.D. (pyrexia), and numerous others were treated regimentally.

There is no reason to suppose that what happened in this company as the result of the treatment would not also approximately happen in a whole battalion, a whole division, or a whole corps, if the treatment were as thoroughly and carefully carried out; and I have no doubt that if this were done the number of relapses occurring in the spring months would be immensely reduced. A roll could be kept of the men who resisted the treatment and remained carriers, and they could either be sent out of the country or kept at the base, or on the lines of communication, where the presence of carriers is not of so much importance, as there is already an infected native population there. If this were done, it would greatly reduce the number of infected anophelines in the Corps areas, and consequently lessen the incidence of malaria.

PART III.

By Captain J. WARNOCK.

Royal Army Medical Corps.

O. i./c. Mobile Bacteriological Laboratory.

Laboratory Notes on Malaria with special Reference to the Treatment of a Series of Unselected Cases.

The series of cases considered was chosen under the direction of Colonel G. T. Rawnsley. Each man had a clear past history of clinical malaria, and was so selected as to be roughly a sample of the malarially affected troops.

The treatment adopted was a continuous twenty-eight days' quinine course of thirty grains daily combined with arsenic in small increasing doses.

The usual methods of investigation have been employed throughout, and conclusions drawn from the consideration of this special series as well as from the routine examination of the many thousand specimens which the material of this army has provided.

The points considered have been:—

(1) Continuous clinical records of temperature, pulse, weight, etc., among the fifty-one special cases.

(2) Untoward effects of quinine, if any, such as vomiting, giddiness, deafness, defects of vision, etc.

(3) Laboratory examinations directed to the condition of the blood and the study of the malarial parasite.

Control examinations were made in a number of "healthy" men chosen so far as could be determined from amongst those who had not had malaria and who had served only for a short period with this army.

As an introduction to the detailed account, some general observations may be made on the malarial question as it arises here.

(*a*) The whole natural picture of malaria has been necessarily clouded by the complication of quinine treatment.

(*b*) Malarial patients are often much more seriously debilitated, even after a few attacks, than the blood examination would suggest, and conversely the blood will often show an enormous number of cells invaded by the parasite with no corresponding clinical gravity of effect.

(*c*) All three classical types of malarial parasite have been found. The quartan parasite has been extremely rare but the benign and malignant tertian parasites have been universally prevalent and a seasonal variation has been strictly observed.

In the early months of the year, benign tertian alone was seen and gamete forms were relatively frequent; with the advance of summer however the gamete forms became less and less in evidence, but again increased in proportion with the commencement of the winter.

The malignant tertian parasite appeared about mid-July and increased in prevalence through the hotter months, declining in numbers with the autumn temperature, though still accounting for most of the severe cases until toward the end of November, when the benign parasite in "relapse cases" became again the common type.

It may be added that thick-and-thin film methods of examination have been employed, and that thin films have been found most generally useful, thick films being, however, the method of choice for the discovery of pigmented, more especially the crescent, forms.

(*d*) Quinine treatment and diagnosis. Malarial pyrexia is so generally reduced by moderate doses of quinine, e.g., thirty grains daily, that a temperature over 99° on the fourth day is a practical exclusion of malaria.

The response, or absence of response, to quinine treatment is therefore practically decisive from the point of view of diagnosis. This statement refers to the "ordinary case," and qualifications will be dealt with later.

(*e*) Quinine in moderate doses quickly banishes asexual parasites from the peripheral circulation, so that, often after one dose, and usually after three doses of ten grains, microscopic diagnosis becomes very tedious.

The gamete forms are not so influenced, but their numbers are not generally great.

Following these general statements some detailed figures may be given of the results of the inquiry into the effects of the combined quinine and arsenic treatment carried out under more or less active service conditions.

I.—*Clinical Records.*—These may be shortly summarized:—

(*a*) There was no difficulty with continuous administration of quinine, and no unpleasant effects noted beyond very slight vomiting, easily corrected, which occurred in a few cases in the fourth week of treatment.

(*b*) All the men looked better with two exceptions; one case (malignant tertian) will be detailed later, and the other was under special vaccine treatment for boils.

(*c*) An average increase of weight of five pounds was recorded. In only five cases was a decrease noted; two of these were the cases mentioned above, and the decline of the others (two pounds) was so slight as to be negligible.

(*d*) Cardiac response to exercise was much more healthy at the end of treatment than before.

II.—*Laboratory Examinations.*—Attention was directed to:—

(1) Discovery of the parasite and inquiry into its reaction to quinine medication.

(2) Hæmoglobin estimations.

(3) Counts of red and white blood cells.

(4) Differential counts of white cells.

(5) Inquiry into a possible fragility of the red cells of men undergoing quinine treatment and a possible hæmolytic action of the serum.

(1) The malarial parasite was discovered in nineteen out of the fifty-one cases (M.T. 6, B.T. 9, ? type 4); two of these cases were continuously apyrexial and two others only once reached 99°. In general, it may be stated that benign tertian parasites are not often found in the apyrexial period during the season of prophylactic quinine.

It has been determined, however, by a commission working under the direction of Lieutenant-Colonel L. B. Dudgeon, Consulting Bacteriologist to this army, that during the winter months a careful search will reveal the parasites in apyrexial "malarial carriers" in a considerable percentage of the cases.

In one of the fifty-one cases crescents were found up to fourteen days after commencement of quinine treatment; such a discovery of crescent parasites after the period of treatment with thirty grains daily has been a common observation.

In a second case crescents, in small numbers, were demonstrated up to forty-six days' treatment.

In no case were asexual parasites found after three days' treatment.

The effect of quinine treatment in the pyrexia of malaria has already been referred to and a general diagnostic rule laid down.

Qualifications of this rule must be made, however, in the many severe cases of malignant tertian malaria which have been, throughout the autumn, far from uncommon.

Fever of four, five, or six days' duration, with occasional irregular slight rise of temperature afterwards, is a common occurrence as an almost typical eight days' chart of a "moderately severe" case here presented would show.

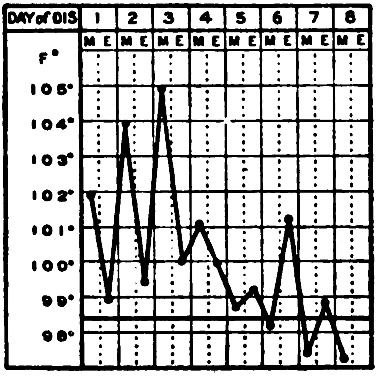


CHART 1.

In addition to these more usual types of case, rarer cases of more or less continued slight pyrexia occur on which quinine treatment would appear to have very little influence.

One such case occurred amongst the special series of post-malarial cases dealt with, and a chart with details is given. In this case no parasite was discovered, in spite of very many repeated examinations both at the beginning and during the progress of treatment.

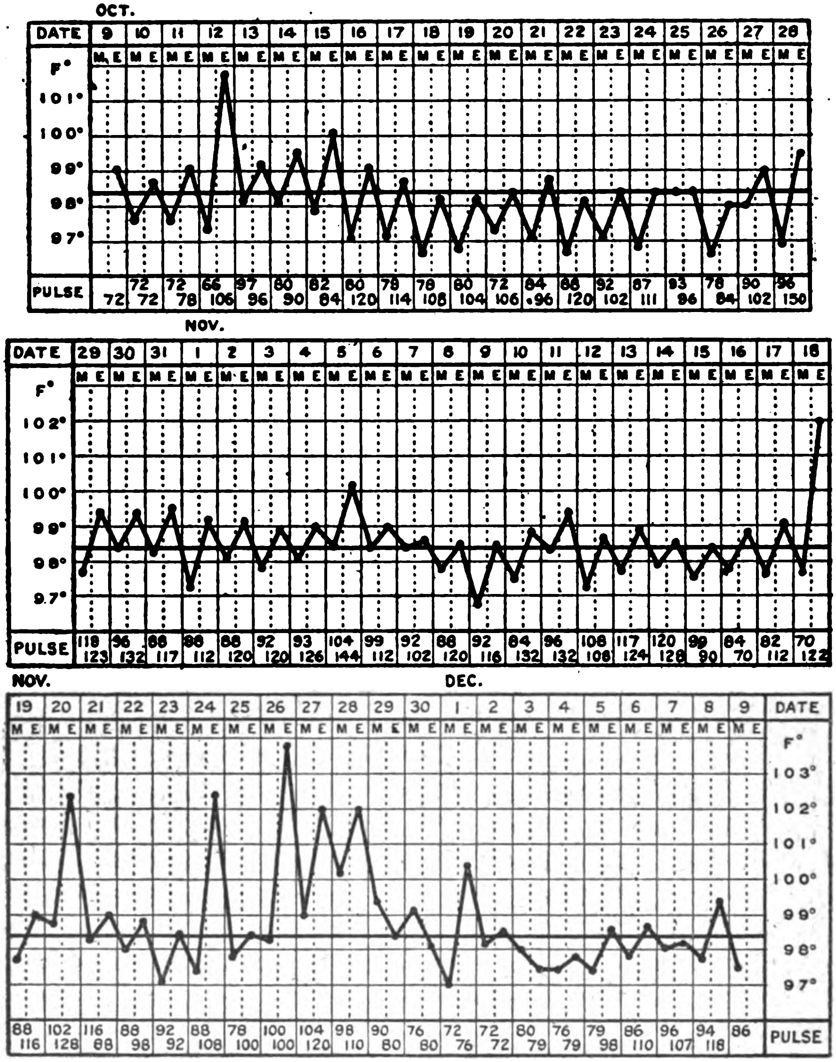
This negative consideration, and also the absence of a palpable spleen and the existence of a high leucocytic count (9,000 to 13,000), combined with the irregular pyrexia, led to the alternative suggestions of oral sepsis, enterica and tuberculosis, for all of which hypotheses diagnostic procedures were employed with negative results.

After six weeks' continuous treatment (thirty grains daily) quinine was abandoned and in five days numerous malignant tertian rings appeared in the peripheral circulation coincident with a "bilious" vomiting and a typical attack of malignant tertian fever. Quinine was then again resumed in larger doses (forty-five grains daily), the first dose being intramuscular owing to the vomiting; the condition, however, seems to have been more or less controlled, but not shortened by the treatment.

(2) Hæmoglobin estimates: Figures here are restricted to the small

series of fifty-one selected cases and the results have been extremely striking. A rapid rise in hæmoglobin value was immediately obvious, corresponding with the improved general appearance and physical fitness of the men.

CHART OF CASE 28.



The average increase was fourteen per cent at the end of treatment, but the closest grouping of figures approximated to 17·5 per cent, and this may be taken as what might be termed the "expectation of improvement."

Extreme cases of thirty per cent and forty per cent increase were recorded.

Comment may be made on the fact that most of the cases at first had hæmoglobin estimations of 70 to 75 per cent, while a series of normal men gave values 85 to 90 per cent.

This difference in oxygen-carrying capacity of the blood is not enough to account for the obvious physical unfitness affecting nearly the whole series examined and would suggest that the malarial organism produces its effects more by a general toxæmia than by a limited destruction of the red blood cells. That this is so is evident from the intense tissue destruction found post mortem in practically all the fatal cases, even when macroscopically, beyond enlargement in the spleen, there may be no obvious disease or cause of death.

(3) Red counts: In the special series considered, an increase parallel to the increase in hæmoglobin was observed. The average increase was fourteen per cent.

White cell counts: Observations were, for the sake of comparison, made always at the same time of the day, but owing to the known normal variations actual figures are of little value. Hence general conclusions may be given to which it was found that the small special series also conformed.

In the apyrexial period counts below 3,000 or above 9,000 are not common, while 4,000 to 6,000 would appear to be the general rule.

During an "attack," a more marked leucopenia is often found, but the exceptions are so common that this can scarcely be accepted as a rule; it would appear that very low counts only occur if there is marked anæmia, while if the attack is resistant or severe a high count is more likely to be found.

(4) Differential counts of white blood cells: These estimations again made over a large number of cases have given interesting results.

The figures may be best presented by considering definite illustrative series. Only three cell types for the moment are considered.

	Average percentage count of cells		
	Polymorphonuclear	Lymphocytes	Large hyalines
Series 1.			
Fifty cases of benign tertian fever during an attack and before commencement of quinine treatment	54	27	17
Series 2.			
Fifteen cases of malignant tertian, also during attack and before quinine	44	31	23
Series 3.			
Twenty-five cases of unverified malaria, during attack and before quinine	58	24	16
Series 4.			
Fifty cases of afrebrile "post-malaria" cases during treatment with quinine	45	34	19
Series 5.			
Fifteen cases where malaria could be practically excluded	48	42	10

Comment on these figures as regards the deviation from the normal is unnecessary, except for the inclusion of the last series, which was strictly chosen to exclude malaria but to include men who had served for at least one summer in this country.

It will at once appear that an increased percentage of large hyaline cells is of little diagnostic value in malaria; since a similar phenomenon appears to be produced by climatic or other causes amongst healthy troops serving with this force.

The numerical differences above detailed are not the only deviations from the normal, for not only is the total mononuclear count increased, but the type of cell differs widely from that found in health. Typical lymphocytes and large hyaline cells are found, but there are also present types not seen in normal blood, but occurring in the bone marrow and the spleen. Typical myelocytes are sometimes found and large finely granular mononuclear cells suggesting gradations between true myelocytes on the one hand and polynuclear cells and large hyaline leucocytes on the other. The number of these cells varies and appears to have some relation to the severity of the case. The actual number has not been noted above five per cent of the total white cell count.

A further malarial abnormality is the presence of the characteristic pigment in the large hyaline and polymorphonuclear cells. This occurrence has been looked for over a series of several thousand specimens, and while pigment in both types of cell has been occasionally seen the examples have been so extremely rare that the observation can have no value in the diagnostic sense. The conclusion, therefore, drawn from this method of inquiry has been that a microscopic diagnosis of malaria must, for all practical purposes, be based entirely on the discovery of the parasite.

(5) Inquiry into a possible quinine-induced fragility of red blood cells or hæmolytic action of the serum.

That quinine treatment may damage the red cells in ordinary cases and even under special circumstances predispose to, or cause, blackwater fever has been often stated. Barret and Yorke have proved that quinine in dilution approximating to that ordinarily present in the circulating blood after administration has no hæmolytic action on washed red cells.

Sampson and Edie have, in a short series of men and animals, determined the total excretion of urobilin and have hence deduced a probable hæmolytic power. Their series, however, has been so short and the results so varying, that any conclusions must be uncertain.

Our examinations have been limited to thirty cases. A small but almost constant difference has been found amounting to 0·025 per cent in the strength of saline which just produced hæmolysis, to this extent the series treated having less fragile cells than the series of "controls," and in the same sense the serum observations have discovered no hæmolytic action, the deviations from control figures in the few cases which occurred being in the direction of protection of the cells. The numbers, however,

so far examined have been too small from which to draw definite conclusions, beyond the fact that any untoward influence of quinine in the blood, if present, must be very slight, and is probably more than counterbalanced by the conjunction of arsenic.

Summary.

For the sake of clearness, conclusions may be summarized regarding the possibilities of the standard quinine treatment.

(1) No deafness, visual defects or other disadvantages are likely to accompany or follow the administration of quinine thirty grains daily for three to four weeks.

(2) The general health and physical fitness of malarial cases so treated will markedly improve under treatment.

(3) Arsenic is a valuable adjunct to quinine in the treatment of malaria.

(4) Few relapses are likely to occur and fresh infections can be dealt with as they arise (no relapse, excluding one uncured resistant case, occurred amongst the special series treated, after four weeks of very severe weather since cessation of the treatment).

(5) The malignant tertian parasite would appear to be the most resistant type. Relapse cases occurring in the early months of the year are generally benign tertian; it is probable, therefore, that a three to four weeks' course of thirty grains daily will cure a considerable proportion of the men so treated.

(6) A possible difference in the parasite found in this country from that seen elsewhere has been often mentioned. It would seem probable, however, that the different effects produced may be due to indefinite and irregular quinine administration.

(*To be continued.*)

Clinical and other Notes.

ANÆSTHETICS IN THE FIELD.

By Captain W. R. H. HEDDY.
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Comparatively few surgical operations are now performed in the immediate vicinity of the firing-line, since it is the routine practice to evacuate cases requiring operative treatment to the casualty clearing station with all possible speed. There are, however, circumstances in which the administration of anæsthetics to patients in field ambulances may be indicated, and it is the purpose of this article to discuss briefly the conditions in which the employment of anæsthesia may be useful and to give a short account of the equipment available.

It well be well to deal initially with the question of equipment. The most important items of the anæsthetic outfit are contained in field surgical pannier No. 1, which includes among its contents chloroform (three pounds) in sealed glass tubes, two drop-bottles, a hypodermic case with the essential drugs, and an excellent saline infusion apparatus. Further supplies of chloroform (one pound) are to be found in field medical pannier No. 1, together with a spare drop-bottle and a reserve set of hypodermics. Medical units in the field have lately received certain additional articles of operative equipment in the shape of an "outfit," which includes among other things a mouth-gag, tongue-forceps, and a Skinner's mask. Ether is also now available, while should the administration of oxygen be urgently indicated, even this commodity will frequently be at hand, though it must be remembered that oxygen cylinders are supplied to dressing-stations for another purpose and should accordingly only be made use of in cases of grave emergency. There is always plenty of lint and gauze, a stomach tube can be improvised, and there are good rubber hot water bottles. Lastly, there is a set of tracheotomy instruments of an up-to-date pattern. It will thus be evident at once that from the anæsthetist's point of view the equipment of a field ambulance leaves nothing to be desired. It may be added that all the materials supplied are of admirable quality.

The cases which may require the administration of an anæsthetic before being evacuated to a casualty clearing station may be divided into three main classes:—

(1) Cases where it is desirable to dress or redress a severe wound of an extensive nature or to immobilize a fracture.

(2) Cases where it is considered necessary to perform an immediate operation for the relief of some urgent symptom.

(3) Cases of wounds or injuries accompanied by shell-shock of an acute maniacal type.

In the first group of cases are included severe shell injuries which can only be thoroughly investigated when the patient is under an anæsthetic owing to the extent and situation of the wound. The cleansing and dressing of many cases of this type cannot possibly be carried out properly without anæsthesia, yet adequate

disinfection of a wound at an early moment may mean all the difference between recovery and death from septicæmia. Again, something more than the first-aid treatment of fractures is necessary in order to secure the comfort of patients who may subsequently have to make a journey of several miles in a motor-ambulance over bad roads. In these cases the value of anæsthesia in facilitating investigation and treatment is at once apparent. The administration of ether or chloroform is usually necessary in cases of severe burns, owing to the extreme pain which dressing of the parts entails.

It must be clearly understood that many of the cases in this first group would, in time of great stress and urgency, be evacuated from the dressing station almost immediately. It is at normal periods that the conditions are most suitable for the exercise of the methods outlined above. There are undoubtedly many advantages in dealing as effectively as possible with patients in field ambulances when the opportunity presents itself.

The majority of these cases offer the anæsthetist little difficulty. There are, however, certain complications which are always likely to be met with when a patient is anæsthetized within a short distance of the line. They may be briefly summarized as follows: (1) Shock; (2) hæmorrhage; (3) vomiting; cardiac collapse.

Shock is usually present in a greater or less degree in cases of extensive and destructive injury to the tissues, even when the part involved is in a relatively insensitive area. Hæmorrhage is of less common occurrence, the torsion of the vessels which usually takes place in the severe laceration resulting from large shell wounds effectually preventing much loss of blood. Occasionally severe venous bleeding has occurred before the patient's arrival at the dressing station, and he may then exhibit definite symptoms of collapse which call for the exercise of special care. An attempt should always be made to differentiate between collapse due to shock and that resulting from hæmorrhage, since treatment by intravenous saline, of the utmost value in some cases of hæmorrhage, would now appear to be contra-indicated in conditions of shock.[1]

Vomiting is of frequent occurrence and is often very troublesome. The explanation of its frequency is to be found in the fact that the patient has almost certainly been given a quanity of stimulating fluid to drink after being hit, either at the aid-post or on arrival in the field ambulance. Interrogation of a patient will often elicit the information that two or three cups of hot soup or coffee have been taken during the journey down from the trenches, with the result that the stomach is distended with fluid at the time of operation. It is well to bear this fact in mind and to remember that an empty stomach is the exception rather than the rule. In cases where a man has been wounded immediately after a heavy meal and has been brought in for operation a stomach tube should be passed and the gastric contents removed.

Symptoms of cardiac failure are not common in this class of case, but this possibility must always be guarded against in view of the fact that the patient has almost invariably been treated with an injection of morphia before coming under the anæsthetist's hands. It frequently happens that more than one injec-

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[1] "Surgical Shock and some Allied Conditions" (Medical Research Committee), *British Medical Journal*, March 24, 1917.

tion has been given, and I have seen cases where misguided energy in this direction has nearly led to the patient's undoing. A severely wounded man who has been given an excessive amount of morphia before being brought in is scarcely in a fit condition for the administration of an anæsthetic even under the most favourable circumstances. The greatest care is necessary in dealing with cases which have been overdosed in this way, circulatory failure occurring very frequently even under ether.

For the dressing of wounds and the immobilization of fractures anæsthesia may be conveniently induced with the A.C. mixture (alcohol one part, chloroform nine parts), and maintained with open ether or the original agent. Ether should not be used extravagantly or unnecessarily, for it is now an expensive commodity. It is, however, readily obtainable from the advanced depot of medical stores. The A.C. mixture is usually very well borne. It should be administered from a drop-bottle and should invariably be given by the open method on a folded square of lint held well away from the patient's face. Given under these conditions it forms an admirably safe and effective agent. Little muscular relaxation can, however, be produced at an early stage of anæsthesia, and the more complete degrees necessary for the manipulation of fractures are more readily obtained by the use of ether. The widespread habit of cigarette smoking is responsible for a great deal of chronic pharyngeal irritation, which is met with very frequently among patients of all ranks, and unless atropine $\frac{1}{120}$ grain is given as a routine practice before the commencement of etherization considerable difficulty may be experienced from the accumulation of mucus in the throat. Ether should be given by the open method, the mask being covered with eight thicknesses of gauze. A narrow ribbon of gauze may be interposed between the side of the bottle and the cork in order to maintain a continuous flow, a bottle with a perforated cork and two-way tube not being available.

Formal surgical operations are occasionally undertaken in field ambulances, immediate operative treatment affording the patient the only chance of recovery. The majority of such cases are of an exceedingly grave type, amputations and laparotomies being perhaps most common. These patients are naturally difficult subjects for anæsthesia and need the greatest care and attention. Induction is best carried out with a C.E. mixture (chloroform two parts, ether three parts) given on folded lint by the open method, anæsthesia being subsequently maintained with open ether and oxygen. I believe that pituitary extract is of real value in these cases in maintaining the blood-pressure and tiding the patient over a dangerous period. At the same time every effort should be made to maintain the body temperature, and too much stress cannot be laid on the necessity for keeping these cases under careful observation after they have been removed from the operating table. They should be placed in the warmest available position, while an orderly should be placed in special charge of each patient in order that he may be properly looked after and any change in his condition reported at once. In the hurry and confusion of dealing rapidly with a large number of patients these cases are apt to be neglected once the operation is over, chiefly owing to the fact that the nursing staff do not sufficiently realize the gravity of their condition. These operations, frequently undertaken under most adverse circumstances and solely with the idea of giving the patient some slight chance of recovery, are occasionally brilliantly successful, and the anæsthetist should be prepared to take any risk which the decision to operate may involve.

Certain cases of shell-shock arrive at the dressing station in a state of excitability bordering on acute mania. Very frequently such patients have some wound or injury which needs to be treated, but owing to the violence of their struggling it is often exceedingly difficult to deal with them. A little chloroform or C.E. administered very cautiously and gradually will save an infinite amount of time and unpleasantness, while the wounds can be properly dressed, the patient removed to a suitable spot, and due precautions taken before the return of consciousness. Unless there is reason to suppose that an injection of morphia has already been given, ½ grain may be administered, with an added small dose of hyoscine at the conclusion of anæsthesia.

NOTES ON THE TREATMENT OF AMŒBIC DYSENTERY WITH EMETINE AND BISMUTH IODIDE.

By Captain A. C. LAMBERT.
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During the months of July and August, 1917, forty cases of amœbic dysentery admitted to a military hospital in Mesopotamia were treated with emetine and bismuth iodide, used either alone or in conjunction with emetine hydrochloride.

These cases formed twenty-five per cent in July and thirty-four per cent in August of all cases admitted in which blood and mucus were present in the stools. They also furnished all the severe cases and the deaths from dysentery during the above period. Four deaths occurred, in two of which hyperpyrexia from the intense heat undoubtediy hastened the end. The remaining two were due to peritonitis following perforation of dysenteric ulcers, and occurred in very debilitated subjects two or three days after admission.

The duration of the disease before admission to this hospital varied from three days to a fortnight, the average being about six days. In many cases could be elicited a history of previous attacks of dysentery in either Mesopotamia or India.

All patients treated were natives of India, and came from widely separated districts of that country. As this was the first opportunity afforded the writer of making a trial of emetin and bismuth iodide in a series of cases of amœbic dysentery the diagnosis of which could be confirmed, and the results of treatment checked by microscopical examination of the fresh stools, the following points were considered worthy of investigation:—

(1) The tendency, or otherwise, of the drug to produce vomiting.

(2) Its action, either when given alone, or in conjunction with emetin hydrochloride, in

(*a*) Acute cases showing active amœboid forms in the stools;

(*b*) Less acute cases in which encysting forms are appearing in the stools;

(*c*) Chronic relapsing cases; the results in all cases being checked by microscopical examination of the stools.

(1) The action of the drug in producing vomiting had to be taken into consideration, as keratin capsules were not available, and the drug had to be administered in the form of a powder or pill. Happily it was found that the Indian tolerates the drug very well. The maximum single dose of three grains was never exceeded, and not more than four grains were given during the twenty-

four hours. The most suitable dose was found to be one of two grains, in pill form, given once or twice a day, half an hour after a feed of milk, the pills being freshly made from the powder with a little gum excipient. A few of the cases complained of nausea after taking the drug, and sometimes the patient would vomit an hour or two later, but this was readily checked by the administration half an hour before of 15 drops of tinct. opii; tolerance was established in two or three days, and in no case did it become necessary to discontinue the drug from this cause.

(2) The cases divided themselves pretty definitely into the three classes given above, so that the action of the drug can be considered in its relation to each class.

ACUTE CASES.

In those cases in which the disease had been present three or four days, and in which several stools containing mainly blood and mucus were passed during the twenty-four hours, microscopical examination showed the presence of numerous amœbæ of histolytica type. In the treatment of this class, the best results were obtained by using two grains of emetin and bismuth iodide in pill form at night, and one grain of emetine hydrochloride hypodermically in the morning. A more rapid relief of the acute symptoms was obtained by this method than by the use of either drug alone; in fact, emetin and bismuth iodide when given alone in acute cases did not appear to have the same rapid action in relieving pain and tenesmus as emetin, but when used in combination with the latter drug in the above manner it certainly shortened the attack, and established a more complete and earlier convalescence. The rapidity with which the stools became fæcal and lost their blood and mucus was in some cases remarkable. Furthermore, there did not appear to be the same tendency to constipation, which so frequently follows the use of emetin alone.

The microscopical findings showed a rapid decline in the number of amœboid forms in the stools after twenty-four hours, and by the end of a week the stools were reduced to one a day, were in appearance normal, and apparently free from amœbæ in any form.

Case 1.—Havildar major, admitted August 5, 1917, with symptoms of dysentery. Had been in hospital a fortnight previously with diarrhœa, which cleared up under salines. No amœbæ found at that time in the stools. On second admission he was passing five or six stools daily, consisting solely of blood and mucus, and containing numerous amœbæ of histolytica type. Emetine, one grain hypodermically in the morning and emetine and bismuth iodide three grains in pill at night, commencing on August 6. Slight nausea, but no vomiting after taking pill. Toleration established after two days.. On August 10, dose of emetine and bismuth iodide reduced to two grains. Blood and mucus absent from stools on August 8, and pain and tenesmus disappeared. Stools one daily, semi-solid, until August 14, when they became solid and free from amœbæ. Returned to duty on August 17. Total emetine injected, twelve grains. Total emetine and bismuth iodide given, twenty-eight grains.

Case 2.—Driver, admitted July 23, 1917, with severe acute dysentery of four days' duration. Passing numerous stools containing much blood and mucus. Active amœboid forms of *E. histolytica* present. Treatment commenced on July 24, with emetine one grain hypodermically in the morning, and emetine

and bismuth iodide three grains at night. Griping and tenesmus relieved after twenty-four hours. Blood and mucus in diminishing quantities present in stools up to August 1. One normal stool passed on August 3, which was free from blood, mucus and amœbæ. Patient then transferred to another hospital.

SUBACUTE CASES IN WHICH CYSTS WERE PRESENT.

In cases which had passed the acute stage when admitted, and whose symptoms consisted of pain and tenderness along the course of the large bowel, more marked over the cæcum and lower part of descending colon and rectum. and the passage daily of two or three semi-solid or liquid fæcal stools containing a little mucus and a trace of blood; good results were obtained by giving two grains of emetine and bismuth iodide in pill morning and evening, with an occasional dose of ½ ounce of sulphate of soda. Mucus and blood disappeared rapidly under this treatment, the tongue became clean, and the abdominal tenderness diminished, while, so far as could be judged with the laboratory appliances at disposal, cysts ceased to be found after five or six days of treatment. Treatment was continued until a total of thirty-six to forty grains of emetin and bismuth iodide had been taken. Diet consisted of milk, sago and rice pudding, chicken soup and eggs.

Case 3.—Sepoy, admitted on August 18, 1917, complaining of diarrhœa, pain and tenderness along the course of the large bowel and the passing of small quantities of blood and mucus in the stools, of which he had two or three daily, Duration of illness fifteen days. No history of previous attacks. Two and four-nuclear cysts found in stools. After a preliminary dose of ol. ricini, treatment was commenced on August 19 by giving two grains of emetine and bismuth iodide morning and evening. Blood and mucus were absent on August 21, and the stools were normal and apparently free from cysts on August 23.

Case 4.—Driver, admitted on August 16 1917, complaining of diarrhœa, with the passage of small amounts of blood and mucus. Two to three stools daily. Illness of about a fortnight's duration. No history of previous attacks. Cysts in stool containing up to four nuclei. Emetine and bismuth iodide in two-grain doses twice daily commenced on August 18. Stools normal and free from cysts on August 21.

CHRONIC RELAPSING CASES.

Under this category are classed cases who had had one or more previous attacks of dysentery from which they had never fully recovered. When admitted to hospital they were very debilitated and anæmic. Usually of the "follower" class, they had continued their duties long after they should have reported sick. The stools passed, often sixteen to twenty in a day, consisted of blood, mucus and sloughs, while not infrequently blood alone was passed, and in considerable quantity. Great tenderness was complained of along the whole course of the large bowel, and there was much griping and tenesmus. Emaciation was extreme in some cases. These cases furnished all the four deaths occurring during the period under review, and the post-mortems showed extensive ulceration and gangrene of the whole of the large bowel from cæcum to anus. The stools contained numerous amœbæ in all stages of development. Owing to the severity of the symptoms it was necessary to get these patients as quickly as possible under the influence of emetine, in order to destroy the amœboid forms which were

doing such harm to the already damaged coats of the bowel. Emetine hydrochloride, therefore, was given at first in doses of from a half to one grain, hypodermically twice daily. Later on, as the symptoms improved, one or two grains of emetine and bismuth iodide were substituted for one of the doses of emetine. Small doses of morphia were used to allay pain and tenesmus, and promote sleep. Stimulants, such as brandy or port wine, had generally to be given, and in such debilitated cases the diet had necessarily to be bland, nourishing, and readily assimilable, and consisted of milk, milk and eggs, meat essences, milk puddings and light soups. Convalescence in these cases was prolonged, and return to normal dietary had to be carefully regulated.

Case 5.—Dhoolie-bearer D., admitted on August 6, 1917, with diarrhœa and debility, and a history of several weeks of ill-health, abdominal pain and the passing of mucus with the stools. He was passing from sixteen to twenty stools daily, was very weak and emaciated, and could scarcely articulate. He had continued on duty till forced by weakness to seek medical aid. Liver and spleen not palpable. Temperature 99° to 100° F. Pulse very rapid and weak. Tongue furred, dry, and protruded with difficulty. Lungs showed poor air entry and signs of old pleurisy. He was at first considered to be a case of phthisis, with diarrhœa, but no tubercle bacilli could be detected in the sputum. Blood was negative as regards malaria. Examination of stools showed, at first, no amœbæ, but on the 10th there was a little blood and mucus in the stool, and amœbæ were then found. He was at once put on emetine hypodermically, in doses of one grain daily, and on the 13th, when the symptoms had improved, and his general condition was better, two grains of emetine and bismuth iodide were given in the evening to supplement the emetine. The former drug was well borne and caused no vomiting. By the 15th there was slight improvement, but patient was still very weak aud depressed and was passing five or six stools a day. On the 17th he was much better, and there was no blood and mucus in the stools, and the emetine was discontinued. On the 19th, the stools contained neither amœbæ nor cysts, but the emetine and bismuth iodide were now given in two-grain doses twice daily. The appetite had returned, and the patient commenced to pick up. Medicinal treatment was stopped on September 1, after a total of nine grains of emetine and forty grains of emetine and bismuth iodide had been given. A few days later the patient was transferred convalescent to another hospital.

The above case is a very fair illustration of the action of emetine and bismuth iodide in severe amœbic dysentery in debilitated subjects.

No mention has been made of the use of enemata, and, in fact, very little use was made of that method of treatment. In the milder cases it did not appear called for, and in the severe type similar to the last described it seemed to be a highly dangerous proceeding, considering the state of the bowel in these cases, as illustrated post mortem. Appendicostomy or cæcumostomy were not attempted, as the cases were too debilitated to stand operative interference, and their symptoms appeared to be relieved to a great extent by medication.

Judging by the results in this small series of cases, it would seem that we have in emetine and bismuth iodide a combination of considerable potency in the treatment of amœbic dysentery, particularly when the amœbæ are assuming their resistant stage. When given in pill form in doses not exceeding two grains, its emetic effects are slight, at all events in Indian cases. Its use in conjunction

with hypodermic injections of emetine hydrochloride in acute amœbic dysentery would seem to be beneficial, in that convalescence is established earlier and patients are less likely to become "carriers." It cannot be considered in the light of a substitute for emetine, as attempts to treat acute cases with it alone ended in failure, until emetine was used in addition.

In "carriers" and in those convalescents who continue to harbour cysts, emetine and bismuth iodide should prove superior to emetine, and it would seem a wise proceeding, from a public health point of view, to subject all cases of amœbic dysentery to a course of emetine and bismuth iodide during convalescence.

I wish to express my grateful thanks to Colonel W. H. Willcox, C.B., A.M.S., consulting physician to the forces in Mesopotamia, for his kind and valuable advice and help in the treatment of the cases, and the compilation of these notes. And also to my indefatigable assistant, Sub-assistant Surgeon Bashi Ram, without whose intelligent aid and knowledge of the vernacular the cases could not have been systematically treated or noted.

NOTES ON THE TREATMENT OF SUBTERTIAN CEREBRAL MALARIA WITH QUININE AND GALYL.

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AND
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Salvarsan and neosalvarsan have been used to a considerable extent during the last six or seven years in the treatment of malaria. Most observers are agreed that these drugs, especially when associated with quinine, are of value in infections with the benign tertian and quartan parasites, but are of little value against infections with the *Plasmodium laveraniæ*. Although quinine alone may justly be termed a specific in the treatment of most types of malaria, the death-rate from malignant subtertian malaria is yet sufficiently high to stimulate further effort to find an even more efficient therapy.

The following six cases were treated with a combination of quinine and galyl :—

Case 1.—Pte. C., aged 31, admitted to base hospital on September 22, 1916. He had reported sick on September 18, complaining of headache, vomiting, and "the shivers." He stated that for the previous three months he had been having attacks of shivering and sweating at irregular intervals. On admission to hospital his general condition was good, his temperature was normal, and his spleen extended half an inch below his costal margin. He was treated with twenty grains of quinine sulphate three times a day by mouth. He felt quite well and his temperature remained normal until the morning of September 25. On that date his temperature rose to 100° F. and remained up all day. On the morning of the 26th it had fallen to normal, but rose again in the evening to 101° F., and the patient felt sick and vomited. An injection of twenty grains quinine bihydrochloride was administered intramuscularly. On the morning of the

27th another injection of twenty grains of quinine was given intramuscularly. His temperature was normal, and did not rise above normal throughout the day. At noon the patient refused his food, and looked strange; at 3 p.m. he was found to have complete paralysis of the muscles of both sides of the tongue, of the pterygoids and of the masseters. There also appeared to be some weakness of the external recti. There was no paralysis of the limbs, or alteration of the superficial or deep reflexes. The patient was quite conscious and could carry out directions as to the movements of his limbs; the fundi oculorum were normal. A blood-film showed the presence of numerous subtertian rings and crescents. He was given an intravenous injection of 0·8 gramme quinine bihydrochloride. At 8 p.m. the patient's condition was unchanged, except that he now appeared to have some difficulty in understanding what was said to him. There was a definite internal strabismus of the left eye; a further 0·8 gramme quinine was administered intravenously. On the morning of the 28th his condition was much improved. He could open his mouth, protrude his tongue, and articulate slowly. He had some difficulty in swallowing, as fluids tended to regurgitate through the nose. There was still defective movement of both eyes outwards. In the afternoon his temperature rose to 100° F. On this date he was given two intravenous injections of quinine bihydrochloride 0·8 gramme each. On the morning of the 29th his condition was much worse. There was complete paralysis of the tongue, the palate, and the muscles of mastication. There was also complete ophthalmoplegia, and it was doubtful whether the patient understood what was said to him. At 9 a.m. he received a further 0·8 gramme quinine bihydrochloride intravenously. At 11 a.m., as there was no improvement in his condition, he was given 0·3 gramme galyl intravenously. At 3 p.m. the patient was much improved. He could then protrude his tongue, move his jaw, talk slowly but quite intelligently, swallow slowly, and move his eyes. At 9 p.m. he was given a further 0·8 gramme quinine intravenously. On the 30th the patient's condition had continued to improve. There was still some dysarthria, but he was able to swallow without difficulty. He was put on 20 grains of quinine sulphate three times a day by mouth. The improvement steadily continued, but on October 1, as the temperature still rose to 100° F., he was given 0·2 gramme galyl intravenously. The temperature fell that night and remained subnormal during the rest of his stay in hospital. He showed no further symptoms and was transferred to hospital ship on October 18, when there was no evidence of organic nervous disease, and no malarial parasites could be found in the blood.

Case 2.—Sapper R., aged 33, admitted to base hospital on October 4, 1916. On admission the patient's general condition was bad, and the temperature was 103° F. He showed no evidence of any local lesion of the nervous system. A blood-film showed the presence of numerous subtertian malarial parasites. He was given 0·8 gramme quinine bihydrochloride intravenously. On the morning of the 5th his temperature was subnormal, but his general condition was very poor. He was again given 0·8 gramme quinine intravenously, and at 2 p.m. twenty grains of quinine sulphate by mouth. In the afternoon the patient developed marked dysarthria and difficulty in swallowing. The speech was quite unintelligible. The movements of the tongue and palate were present but much impaired. The patient's mental condition was not affected, and there was no paralysis of the limbs or alteration in the superficial or deep

reflexes. At 6 p.m. he received 0·4 gramme of galyl intravenously. On the 6th the patient's general condition was much improved, and beyond slight dysarthria, which rapidly passed off, he showed no evidence of local disease of the nervous system. He was then treated with quinine intramuscularly, and later by mouth, and rapidly became convalescent. He was transferred to hospital ship on October 21, without any evidence of organic nervous disease.

Case 3.—Pte. B., aged 48, admitted to base hospital on the night of October 7, complaining of headache and general weakness. On admission his temperature was 103° F., but fell to 99° F. on the morning of October 8. His general condition was fair, and his spleen extended about one inch below the costal margin. He was treated with twenty grains of quinine sulphate three times a day by mouth. He took his dinner at noon on the 8th without discomfort, but at 4 p.m. it was found that he was unable to swallow his tea, and he rapidly became unconscious. A blood-film showed the presence of numerous subtertian rings and crescents. When seen at 5 p.m. he was lying in a semi-conscious condition, and did not pay any attention to what was said to him. The conjunctival reflex was present and the superficial and deep reflexes were normal. The unconsciousness rapidly deepened, and he could not be roused by any stimulation. He received 0·8 gramme of quinine bihydrochloride at 5 p.m., 7 p.m., and 10 p.m. At 11 p.m. his condition was unchanged, except that his pulse was failing. He then received 0·4 gramme of galyl intravenously. When seen at 6 a.m. next morning he was quite conscious, able to answer questions slowly and intelligently, and swallow. His temperature was subnormal, and remained so for the remainder of his stay in hospital. A blood-film showed the presence of scanty subtertian crescents up to October 15, but he showed no further symptoms and was transferred to hospital ship on the 22nd.

Case 4.—Pte. C., aged 26, admitted to the base hospital on October 10. On admission the patient's general condition was poor, his temperature was 99° F. and his spleen extended about one inch below his costal margin. A blood-film showed the presence of rings and crescents. He tended to be drowsy, but answered questions quite intelligently, and had no complaints. He was given 0·8 gramme quinine bihydrochloride intravenously. On the morning of the 11th the patient's general condition was worse, he was more drowsy, and answered questions with difficulty. The pulse was 120 per minute and feeble. He received fifteen grains of quinine bihydrochloride intramuscularly. At 3.30 p.m. his condition suddenly became much worse; his breathing became stertorous, and his pulse imperceptible; he lay moaning incessantly, and rolling his head from side to side. There was no paralysis, and his superficial and deep reflexes were normal. His temperature was subnormal. At 4 p.m. he became violent, and lay on his left side in the typical attitude of cerebral irritation. He violently resisted any interference with this position. He received 0·4 gramme galyl intravenously. At 9 p.m. the patient's condition had definitely improved. He had slept for two hours and his pulse was better. At 1 a.m. on the 12th he again became rather excited, and was given $\frac{1}{150}$ grain hyoscine. After this he slept, and when he woke was rational, though weak. From this date he rapidly and steadily improved, and on the 22nd was transferred to hospital ship without presenting any further local symptoms.

Case 5.—Pte. L., aged 20, admitted to the base hospital on October 15, 1916, with a diagnosis of malaria. On admission his temperature was normal and he presented no local symptoms. His spleen extended half an inch below the costal margin. He had never suffered from fits nor had any of his family done so. On October 16, whilst in the latrine, he suddenly developed an epileptiform fit. After having been brought back to the ward, he was in a very confused condition, and paid no attention to any questions, but constantly attempted to get out of bed. The blood-film did not show any malarial parasites. His temperature had risen to 101·4° F. During the 16th he continued to have epileptiform fits, and in the twenty-four hours had some twelve in all. The clonic convulsions were general and did not appear to begin constantly in any particular part, but they were always associated with marked deviation of the head and eyes to the left. Between the fits he was either extremely drowsy or violently delirious. At 2 p.m. he received 0·8 gramme quinine bihydrochloride intravenously, and at 6 p.m. twenty grains intramuscularly. On the morning of the 17th his temperature was 101° F. and his pulse-rate 80 per minute. He was very drowsy and had passed no urine. He received twenty grains quinine intramuscularly. At 9 p.m. he developed another fit, and it was noted that the left plantar reflex was extensor; the right plantar reflex was flexor. He was given 0·4 gramme galyl intravenously, and a lumbar puncture was performed. The cerebrospinal fluid appeared to be under increased pressure, and two testtubefuls of clear fluid were drawn off. The cerebrospinal fluid showed no increase in cellular elements. At 8 p.m., as he had passed no urine for thirty-six hours, a catheter was passed, and less than an ounce of urine was obtained. It did not contain any albumin, sugar, or casts. On the morning of the 18th the temperature was normal, and the patient's general condition improved. He answered questions quite readily and was taking his nourishment well. The left plantar reflex was still extensor, and there were marked nystagmoid jerkings of the eyes on lateral movement to either side. The left leg was distinctly weaker than the right, but was capable of performing all movements with a fair amount of force, and there did not appear to be any ataxia of the limbs. Urine was being passed quite freely. He was given two doses of twenty grains quinine intramuscularly on this date. From this date onwards he was treated with quinine, at first intramuscularly, and later on by mouth. Convalescence was uninterrupted. The weakness of the left leg rapidly improved, but the plantar reflex remained extensor for four weeks. The nystagmoid jerkings of the eyes varied somewhat from time to time, but were still definitely present six weeks after the patient's admission to hospital. When able to get up he showed a pronounced reeling gait, and unless supported he tended to fall to the left. He stated that he felt as if his head were being pulled to the left. When made to walk holding his head down to his right shoulder with his right hand, the tendency to reel to the left was diminished, but was still present. There was no Rombergism and no ataxia. The optic disks were normal. He had no further fits after the 18th, and was transferred to hospital ship in February, 1917.

Case 6.—Dr. S., aged 22, admitted to hospital on September 29, 1916. He reported sick on the 21st, complaining of pain in the head and back, and diarrhœa. On admission to hospital, his general condition was fair, his temperature 103° F., his pulse 120 per minute, and his spleen two inches below the costal margin.

He was put on forty grains of quinine sulphate by mouth per day. On October 2, as the temperature was still raised he was given twenty grains of quinine bihydrochloride intramuscularly in addition. On the 4th his temperature did not rise above 99° F., and he appeared somewhat better. On the 5th the temperature again rose to 101·4° F., and he complained of some pain in the neck and a little difficulty in swallowing. No definite affection of the cranial nerves could be made out, but the right plantar reflex was definitely extensor. He was again put on quinine intramuscularly. On the 6th the temperature again rose; he still complained of pain in the neck, and the right plantar reflex was still extensor. The respirations had increased in frequency, and there was some dullness at the base of the right lung posteriorly. He was given two doses of 0·8 gramme quinine intravenously. On the 7th, as there was no improvement, he was given 0·4 gramme galyl intravenously. He died on the morning of the 8th.

Post-mortem.—The whole of the upper and lower lobes of the right lung were solid in a condition of grey hepatization. There was a considerable accumulation of cerebrospinal fluid below the tentorium and some œdema of the pia-arachnoid over the pons and medulla. The brain was hardened in formalin and then sectioned, but it did not show any macroscopic change.

In these six cases galyl was used in association with large doses of quinine. So far we have been able to make only a limited number of observations of the effect of galyl alone on the subtertian parasites in the peripheral blood-stream, but that galyl alone can cause the disappearance of the ring forms of parasite from the peripheral blood-stream is shown by the two following cases.

Case 7.—Sister S., aged 28, admitted to hospital on November 12, 1916, with pyrexia. Numerous subtertian rings were present in the blood. The patient was put on twenty grains quinine sulphate three times a day by mouth. This produced constant vomiting, headache, and very troublesome tinnitus aurium. The parasites persisted in the blood-stream and the pyrexia continued. On November 14 she was put on intramuscular injections of quinine bihydrochloride, twenty grains twice a day. The intramuscular injections were continued for four days, but the patient was extremely intolerant of quinine and complained of violent headache, and tinnitus aurium with occasional vomiting. The temperature was swinging between 97° and 101° F. Subtertian rings were constantly present in considerable numbers in the blood. She was again put on quinine by mouth, but, on account of vomiting, it was impossible to get her to take it regularly. An intermittent pyrexia continued up to November 27, and during this period subtertian rings were constantly present in the blood. On November 27 she received 0·2 gramme galyl intravenously. Her general condition definitely improved, but the blood still showed subtertian rings, although in diminished numbers, up to December 6, when she had a second dose of 0·4 gramme galyl. From this date onwards there was a marked general improvement in her condition, although she still continued to show an irregular pyrexia rising to 100° F. at night; her blood was examined every few days for malarial parasites until her discharge some two months later, but these were not again found. On December 10 typhoid bacilli were isolated from the stools, and on January 2, 1917, she developed a periostitis of the right humerus.

Case 8.—Pte. B., aged 26, elsewhere reported in detail, was admitted to hospital on the night of October 4, 1916. On October 5 his temperature rose

to 102° F.; his general condition was poor, his sclerotics icteric, and he presented gangrene of the toes of both feet. A blood-film showed the presence of rings and crescents, anisocytosis, poikilocytosis, and polychromatophilia. As it was considered possible that a vascular spasm aggravated by quinine might play a part in the condition of the feet, he was not put on quinine but given 0·3 gramme galyl intravenously. His temperature fell that night and remained subnormal throughout the rest of his stay in hospital. His general condition rapidly improved, and a blood-film taken on the 10th was reported negative to malarial parasites. Two other blood-films taken later were also reported negative. Before his discharge to hospital ship he was put on ten grains of quinine sulphate twice a day by mouth.

In this case it will be noted that the crescents also disappeared rapidly from the blood, but in most of our cases of combined quinine and galyl treatment the crescents have been much more persistent, as in the following case.

Case 9.—Pte. K., aged 25, admitted to hospital on December 23, 1916, with a diagnosis of bronchitis. The patient had been in hospital in May, 1916, with a diagnosis of P.U.O., and in October with malaria. He had not felt well since leaving hospital in October, and he stated that he had had frequent shivering fits since then. During September and October he had taken thirty grains quinine by mouth per day, but had only been taking it irregularly in November and December. On admission his general condition was poor. His temperature was 102° F. and rose to 103° F. next day, to fall to normal on the 25th. His blood showed numerous subtertian crescents and rings. From December 24 to 27 the number of crescents met with in counting 200 leucocytes was practically constant, the figures being 100 crescents to 200 leucocytes. On the 27th he was given 0·4 gramme galyl intravenously. On the 29th the crescents had fallen to 50, on the 30th to 36, for every 200 leucocytes. On the 30th he again received 0·4 gramme galyl. On December 2 the crescents had fallen to 24 in 200 leucocytes, on the 3rd to 14, and on the 4th to 7 crescents for every 200 leucocytes. On the evening of the 11th he developed catarrhal symptoms with a temperature of 101° F., but without any rigor. A similar condition was at that time present in the ward and was almost certainly not malarial. The temperature was normal on the 6th, and on the 6th and 7th the crescents numbered respectively 11 and 10 to 200 leucocytes. He received another 0·4 gramme galyl on the 7th. On the 8th his temperature rose again and he had a malarial attack. Rings were found in the blood on the 9th. His temperature became normal again on the 11th and his blood showed no rings, but 23 crescents to 200 leucocytes. He was put on forty grains quinine bihydrochloride intramuscularly once a day, and twenty grains quinine sulphate twice a day by mouth. On the 13th, 14th and 15th his blood showed 8, 7 and 8 crescents respectively to 200 leucocytes. On the 23rd and 24th 1 crescent to 200 leucocytes was found, and on the 25th and 26th no crescents could be found in counting 300 leucocytes. On February 1, 1 crescent was found in counting 200 leucocytes, on the 2nd, 3 crescents to 200 leucocytes. On the 4th and 6th no crescents were found in counting 400 and 300 leucocytes respectively. His general condition was now excellent and he was transferred to hospital ship on February 7th.

With regard to the value of combining galyl with quinine in serious cases of malaria, our experience is yet too limited to permit of any dogmatic statements

as to its efficacy. It will be noted that, in the first six cases reported here, all were seriously ill with definite subtertian cerebral malaria. All the cases recovered, with the exception of one who died of a complicating croupous pneumonia. All had received quinine, several of them large doses by mouth, intramuscularly, and intravenously, without clinical improvement. In all of them, with the exception of the fatal case, the clinical improvement after the administration of galyl was striking and immediate. In none of the cases did the injection produce any unpleasant results, although several of the cases appeared almost moribund before the injection.

In the eighth case, in which it was considered inadvisable to give quinine, galyl alone caused the disappearance of the parasite from the peripheral blood and produced a striking improvement in the condition of the patient.

In Case 7 the patient took quinine in any form with great difficulty, and although she had taken a considerable amount of quinine by the mouth and intramuscularly, ring forms of the subtertian parasite were constantly present in the blood. After the first half-dose of galyl there was a notable clinical improvement, but the parasite could still be demonstrated in the blood. After the second dose the parasites at once disappeared from the blood. The typhoid ran a protracted course, and she developed a periostitis of the left humerus, but in spite of repeated examinations parasites were not again demonstrated in the blood during the rest of her stay in hospital.

In Case 9, subtertian crescents were present in large numbers. Under treatment by galyl alone they diminished from 100 per 200 leucocytes to seven or eight. The patient's general condition very greatly improved, but he still developed a malarial attack with the presence of rings in the blood. These rings disappeared under treatment by intramuscular quinine, and the crescents continued to diminish and were absent on February 7, when he was transferred to a hospital ship.

We consider that we are justified in concluding:—

(1) That the treatment in itself is free from danger.

(2) That, in subtertian malaria which is resisting adequate quinine treatment, or where the condition is sufficiently alarming, the results of the combined galyl and quinine treatment have been encouraging enough to justify a further trial. It must be thoroughly understood, however, that the addition of galyl in no way diminishes the necessity for quinine.

(3) That in cases where, on account of idiosyncrasy, quinine is impossible, a valuable substitute may be found in galyl.

We take this opportunity of thanking Colonel Purves Stewart, C.B., A.M.S., consulting physician to the Salonika Force, for his valuable assistance and advice, which was always at our disposal. To Lieut.-Colonel P. Mitchell, R.A.M.C., T.F., we are also indebted for permission to use the hospital records, and to Captain R. Richards, R.A.M.C., T.F., for the hæmatological and post-mortem reports.

CEREBROSPINAL FEVER: NOTES ON 251 CASES TREATED AT THE SALISBURY ISOLATION HOSPITAL.

By J. E. GORDON, M.R.C.S., L.R.C.P.

Hon. Physician Salisbury Infirmary; Medical Officer in Charge of Salisbury and District Joint Isolation Hospital.

THE following brief notes relate to cases of cerebrospinal fever which have occurred in Salisbury and the surrounding district and in some neighbouring military camps, from December 15, 1914, to June 30, 1917.

The first case was admitted to the Salisbury Infirmary on December 15, 1914, and from that date until February 23, 1915, 36 cases were admitted; of this number, 16 died in the Infirmary, 3 recovered and were sent back to their homes, and the remaining 17 were transferred to the Salisbury and District Joint Isolation Hospital on account of the impossibility of treating the increasing numbers of cases in a ward of a General Hospital. Five of these 17 subsequently died at the Isolation Hospital. The total number of cases, both military and civil (including the 17 mentioned above), admitted from February 23, 1915, to the Isolation Hospital, was 232, making the total number of cases admitted into both hospitals 251.

The following table gives separately the number of military and civil cases, the recoveries and the deaths at all ages and at certain age groups, and the percentage of the fatal cases to the total number of cases in each age group:—

Number of cases at certain age groups	Number of cases	Number of recoveries	Number of deaths	Percentage of deaths to cases	
	Military.				
Total number at all ages	155	101	54	34·8	
Number under 20 years of age	54	31	23	42·6	
,, 20 to 25	55	40	15	27·3	
,, 25 to 30	21	13	8	38·1	
,, 30 to 40	17	11	6	35·3	
Over 40	8	6	2	25·0	
	Civilian.				
Total number at all ages	96	40	56	58·3	
Under 1 year of age	8	3	5	62·5	69·8
1 to 5 years	21	5	16	76·2	
5 to 10 ,,	14	6	8	57·1	
10 to 15 ,,	10	2	8	80·0	
15 to 25 ,,	19	12	7	36·8	38·9
25 to 45 ,,	17	10	7	41·2	
45 to 65 ,,	6	1	5	83·3	85·7
Over 65 ,,	1	—	1	100·0	

From the table above it will be seen that the fatality rate of the military cases, 34·8 per cent, is lower than the corresponding rate for civil cases, 58·3 per cent. The higher fatality rate at all ages among the civilians may in some measure be attributed to the comparatively large proportion of fulminant cases which occurred in the cases in the 1914 to 1915 epidemic period; but in the main it is due to the fact that many of the cases were infants and young children. It will be seen that 53 (or 55·2 per cent) of the civilian cases are under 15 years of age, having a fatality rate of 69·8. Among persons past middle life the mortality rate was also high (85·7 per cent).

When the thirty-six (37·5 per cent) civil cases in the age groups 15 to 45, which most closely correspond to the all-ages group of the military cases are examined,

it will be seen that the fatality rate of the civil cases is 38·9 per cent, and that of the military cases 34·8 per cent. Although the civil fatality rate is four per cent higher than in the military cases, the rates are calculated on small figures, and too much reliance cannot be placed on them.

Of the 251 cases dealt with, there were 47 fulminant cases, 163 severe cases, and 41 mild cases.

The length of illness of 110 fatal cases was as follows:—

Period of illness	Civil cases	Military cases
Less than one week	24	25
One to two weeks	5	4
Two to four weeks	8	12
Over four weeks..	19	13
	56	54

The longest duration of illness before death was 129 and 131 days respectively in civil and military cases.

In the civilian cases there were 56 males, and of these 21 recovered and 35 (or 62·5 per cent) died; and 40 females, 19 of whom recovered and 21 (or 52·5 per cent) died.

The civilian cases, with few exceptions, occurred amongst the working classes, and except in three cases there was a definite history of association with soldiers or camp workmen, or of residence in camp areas.

Civilian patients within a radius of twenty-five miles were conveyed to the hospital by motor ambulance, and even the most severe cases seemed to stand the journey well.

The ambulance used was a 20-h.p. Scout, body of wood, panels with glass windows, interior varnished wood, all washable. The patient was kept warm with hot-water bottles and blankets.

Age Distribution.—The disease may occur at any age, among the cases treated at Salisbury the youngest was 3½ months, and the oldest aged 72 years.

CLINICAL SYMPTOMS AND SIGNS.

In all cases headache was present, usually of a severe type, and there was pain and stiffness on moving the head in varying degrees according to the severity of the case. In two very severe cases there was no stiff neck on admission, but in twenty-four hours this sign was pronounced. Difficulty in swallowing, due to extreme retraction of the head, was present in a few cases. Vomiting, sometimes associated with diarrhœa, was present in 162 cases on admission, and had probably been present in some of the cases admitted unconscious, in regard to which no history of the illness was obtainable. Kernig's sign was present in 199 cases. Twenty cases had herpes on the face on admission. Many cases had rashes on admission, the eruption being of various types, papular, hæmorrhagic, and purpuric spots being most common; two cases had petechial rashes on the joints. Broncho-pneumonia was present in fifteen cases. Bronchial symptoms of a catarrhal type, probably meningococcal in character, occurred in some cases; these were usually of a temporary transient character, lasting only a few days, and did not seem to influence the course of the disease. Convulsions occurred in seven cases at the commencement of the illness; three of these cases were under 1 year of age; of the remaining four, one was 3½ years, one 7½ years, one 18 years, and one 26 years of age. With three patients convulsions occurred at a late stage of the disease, only one of these recovered. Retention of urine (m

frequently observed in female cases) did not indicate a bad prognosis when occurring at an early stage of the illness; it also occurred as a late development in hopeless cases. One hundred and twenty-nine cases, when admitted, were more or less unconscious with delirium, frequently violent and maniacal. Some cases were quite comatose. Hæmaturia was present in four military cases of severe type, two of which were fatal. The other two made a complete recovery. Albuminuria occurred in 11 cases—10 military and 1 civilian—3 of these cases died. Of the recovery cases, one only had albuminuria on leaving the hospital. Strabismus when present generally occurred in infants. A child, aged 5, who recovered, had ptosis of the right eyelid on admission. At least four patients recovered with blindness of one eye, caused by panophthalmitis, and in two cases the eye was subsequently removed. Nystagmus occurred in one case as a complication and sequela, the patient when discharged being otherwise in good health. In three cases orchitis occurred as a complication during convalescence. Total deafness occurred as a sequela in three cases in which recovery was otherwise good. One patient, a male, aged 29, who died after five days' illness, had hemiplegia on admission. Another male, aged 18, had facial paralysis, but recovered with no paralysis. Hydrocephalus was occasionally seen amongst the children affected.

THE TYPE OF THE DISEASE.

Acute Fulminant Type.—Duration of illness from a few hours to five or six days. These cases were usually comatose or semi-comatose on admission with hæmorrhagic rash and incontinence; they were often delirious and troublesome and did not recover consciousness.

Severe Type.—These cases present several varieties; on admission, some did not appear to be very severe, but became so and ended fatally in two or three weeks; others became chronic, the course of the disease lasting sometimes several weeks before death occurred. The latter patients became very emaciated with mental degeneration and incontinence. The rapid recovery of some patients admitted with delirium and high temperature and apparently suffering with a most severe form of the disease, was remarkable. As a rule in severe cases which recovered improvement began in less than two weeks, although it is worthy of note that certain severe cases began to recover after a long period.

Mild Types.—These cases had headache, stiff neck, and generally vomiting; were sensible on admission, and Kernig's sign was present. Convalescence commenced a few days after admission. Cultures from cerebrospinal fluid or throat swabs were positive. The cerebrospinal fluid in these cases was generally excessive in amount, either clear or faintly turbid (cloudy).

Chronic cases became emaciated; those ending fatally usually developed tremor of the hands, sometimes purpuric or petechial rashes, loss of memory and incontinence, and usually took nourishment well. Mental derangement in a chronic case, associated with wasting, tremor, and incontinence, indicate, I consider, a fatal termination; in fact I have only seen one case with these signs recover. On the other hand, I have had recoveries of cases with emaciation, in which the mental capacity has remained good, and after the acute stage the patients have not had incontinence. Three patients were admitted with swollen joints and myocarditis, their condition before admission suggesting acute rheumatism. In these cases meningococci were found in films made direct from cerebrospinal fluid, which in all these cases was turbid and excessive in amount; two of these

cases recovered, the cardiac signs and swelling of the joints disappearing during convalescence. Arthritis affecting the knee or ankle joints occurred in seven patients as a complication or sequela, two of these being fatal cases. The temperature does not appear to take any definite or typical course. Cases with some of the highest temperatures recorded recovered, and in some severe cases of the fulminant type, where the illness ended fatally in a few days, the temperature did not rise above 100° F., or remained normal.

Diagnosis.—For correct diagnosis, lumbar puncture is essential. The cerebrospinal fluid of the first forty-five cases was examined and reported as positive by Dr. Penfold, of the Lister Institute. Of the remaining cases the fluid of 163 was more or less turbid and diplococci were found in films made from the fluid withdrawn, although in some of these cases no growth was obtained from cultures on trypsin agar or blood serum (about 15½ per cent). In two cases the fluid was blood stained, and in one of these diplococci were found and a positive growth was obtained; in the other case no growth resulted, but a throat swab furnished a positive growth. In forty-one cases the cerebrospinal fluid was clear and excessive in amount. In these cases the albumin was generally increased, and in some eight of them a positive growth was obtained by culture. In the other clear fluid cases, the diagnosis was confirmed by subsequent punctures and a positive throat swab was obtained.

The amount of fluid withdrawn varied, the average being from thirty to fifty cubic centimetres. In some cases the fluid was in quantity and under considerable pressure, as much as eighty or 100 cubic centimetres escaping at times through the needle. The cells found in the fluid were chiefly of the polymorphonuclear variety, the diplococci being both extra- and intra-cellular. I have not found the position of the cocci, as regards the cells, to afford any assistance in prognosis. One patient, a male, recovered with nephritis as an after effect; four cases (already mentioned) with impaired vision. In the majority of cases which recovered health has not been completely restored for some months; in others the recovery appeared to be fairly good, many patients having resumed their occupations. The average period in hospital of recovery cases was: civilian cases forty-five days, military cases sixty-six days. Since the opening of a military carrier centre at Sutton-Veny and the transference to this centre of military cases on convalescence, the duration of the stay in hospital of military cases has been reduced, as in 1915 and 1916 military patients were retained in hospital until two successive negative throat swabs were obtained.

Treatment.—I do not think that drugs have any specific action. In the earlier cases (1915), in addition to lumbar punctures and serum, many drugs were tried, soamin, urotropine, neosalvarsan, and potassium iodide, without apparently any decided influence on the course of the disease in various cases, and their use has been discontinued. For the relief of headache and sleeplessness morphia, morphia and atropin, heroin, bromide and chloral, were successful; aspirin was very beneficial in the milder cases. In the severe forms, morphia and heroin were given freely with satisfactory results. Saline solution given per rectum or intravenously, always did good. Brandy was necessary in many cases. Pituitary extract and ether were found preferable to strychnine. Hot saline baths and hot sponging were used a good deal and were found most useful, relieving restlessness and headache, lowering the body temperature and promoting sleep. Lumbar puncture is essential, both as regards diagnosis and

treatment; I have used Barker's needles and canulas, no syringe being used to withdraw fluid.

Serum Treatment.—The result of serum administration in the earlier cases was unsatisfactory, in fact the use of it was discontinued for a time. From April to October, 1915, Flexner's serum was used with fairly good results. During 1916 and 1917 reliance has been chiefly placed on lumbar puncture and the administration of serum. The Lister Institute serum has been employed for military cases, with a few exceptions. For civilian cases, "Burroughs Wellcome" and "Mulford" sera have been employed. In the severest cases, in addition to intrathecal doses, serum has been given intravenously, with saline solution. The administration of adrenalin, ten minims every four hours, hypodermically for twenty-four hours, in cases with purpuric rashes and also for hæmaturia, has given very promising results.

In some cases the result of serum seemed remarkable, and in my opinion, with serum-treated cases, there is more rapid recovery in severe cases, and less likelihood of relapses and sequelæ. The serum is warmed before use and allowed to run in by gravity through the canula with funnel and tubing, the amount of the dose being determined by the amount of the cerebrospinal fluid withdrawn. I think it is advisable never to insert as much serum as cerebrospinal fluid withdrawn, forty to fifty cubic centimetres being a maximum dose at one administration for an adult. Chloroform was the anæsthetic usually given when necessary for lumbar punctures. I have not seen any reason to abstain from giving an anæsthetic in these cases; where serum is to be administered it is better given under an anæsthetic. In the severe cases with rigidity, it is often impossible to puncture without an anæsthetic. In mild cases, where no serum was to be administered, or simply for diagnostic purposes, it was generally quite easy to puncture without an anæsthetic.

Nursing.

The importance of skilled nursing in cases of cerebrospinal fever cannot be overrated and the recovery of several of our patients must be attributed to the constant care and attention they received from the matron and nursing staff of the hospital.

Direct Infection.

The following cases are examples of direct infection:—

(1) F. R., aged 3½ years, was admitted to hospital on February 10, 1915, with a history of one day's illness. L. R., aged 3½, a twin brother of F. R., was admitted on the same day, February 10, 1915, with a history of five days' illness. Both had occupied the same bed; both died.

(2) E. D., aged 27, was admitted to the hospital January 16, 1915, with a history of a few hours' illness; ten days later, her mother, Mrs. D., was admitted, and on the same day the *fiancé* of E. D., a Canadian corporal, was admitted into a military hospital, suffering from cerebrospinal fever. Mrs. D. and the corporal were present when E. D. was removed, and both of them may have kissed or embraced her. All these cases proved fatal.

(3) A little boy, B. H., aged 5 years, died after a very brief illness on December 30, 1916. He was found to be suffering from cerebrospinal fever. On December 31, 1916, A. H. (brother of B. H.), aged 7 years, was admitted to hospital suffering from cerebrospinal fever. He recovered. The brothers had been sleeping together.

During 1917 investigations regarding the type of meningococcus found in military cases were undertaken by the bacteriologists of the Military Hospital, Sutton-Veny. In addition to the positive cases, there were admitted, with symptoms suggesting cerebrospinal fever, 141 cases. Of these, twenty were civilian and 121 military cases. The larger number of military cases may be due to the fact that soldiers with symptoms suggesting cerebrospinal fever are at once sent to hospital. In the civilian cases, as a rule, the disease is fairly definite on admission. Mild cases of cerebrospinal fever in civilians may possibly be overlooked, and if this be so, probably the apparently higher recovery rate of the military positive cases may be attributed to this cause. The ultimate diagnosis of twenty civilian cases admitted as (?) cerebrospinal fever and found not to be cases of the disease was as follows: Influenza, 5; pneumonia, 7; bronchitis, 1; gastro-enteritis, 1; hysteria, 1; tubercular meningitis, 2; tonsillitis, 1; cerebral tumour, 1; poliomyelitis, 1.

In all cases, excepting the two cases of tubercular meningitis, the cerebrospinal fluid was clear, and nothing was found on examination. The final diagnosis of 121 military cases admitted as (?) cerebrospinal fever in which the original diagnosis was not confirmed were as follows: Influenza, 40; sunstroke, 3; concussion of brain and spine, 4; dental caries, 1; dilated heart, 1; epilepsy, 3; pneumonia and broncho-pneumonia, 13; scarlet fever, 4; tonsillitis, 5; otitis, 2; pericarditis, 1; appendicitis, 1; measles, 3; malaria, 1; loss of memory, 1; myalgia, 4; renal disease, 3; cerebrospinal fever contact, 1; bronchitis, 7; vaccinia, 5; gastritis, 2; neuralgia, 2; rheumatism, 5; anti-typhoid inoculation 5; headache, 3.

Dr. Ord has kindly allowed me to give particulars relating to eighteen of the earlier cases who were under his care at the Salisbury Infirmary.

I must also express my thanks to my colleagues in Salisbury for their assistance in administering anæsthetics when necessary, and also to the bacteriologists of the Military Hospital, Sutton-Veny.

Reviews.

Roll of Commissioned Officers in the Medical Service of the British Army. By the late Colonel William Johnston, C.B. Aberdeen: University Press. 1917. Pp. lxxii and 638. $10\frac{1}{4} \times 7\frac{3}{4}$.

To many of the older officers of the Royal Army Medical Corps this volume has an interest apart from its avowed object, in that it was a labour of love on the part of a well-known, highly and justly esteemed officer of the Corps, to whom we owe much more than most of us recognize, even those with some fragments of knowledge on the subject.

The personal note contributed by Sir William Babtie, V.C., with the bibliography of Johnston's work, explains why his memory is so respected—for his personal qualities and for the work he did.

The Roll covers the period June, 1727, to June, 1898, and it is of course essential for the proper understanding of the Roll itself, that some account should be given of the vicissitudes of the Medical Services of the Army at various times. This is naturally technical to a considerable degree and not very easy reading, but one has the impression that part of this ground has been surveyed—more in outline—by other authors in previous articles; if not, it appears desirable that Lieutenant-Colonel H. A. L. Howell should supply such a sketch, for which there is no one better qualified. The development to its present stage of the

Royal Army Medical Corps is now more than a Corps concern; and something to be read and understood by the general public would be of exceptional interest. There is, of course, a good deal about one period (not the least interesting) in the life of Florence Nightingale—probably that period of the Nineteenth Century at which the greatest stimulus was given. But for the older men Colonel Johnston's account revives memories of old contests, old controversies, many of which now seem trivial, though all were stages in evolution.

Of the Roll itself it is difficult to speak except in recognition of the ability, labour and determination necessary for its compilation. It happens that the volume opened casually at pp. 322, 323, i.e., 1842-43, and the name of Sir Thomas Longmore appears under 1843, the first on the Roll of those whom the reviewer knew personally, though Edmund Alexander Parkes and Sir William Muir are known to many—one as a leader in modern hygiene and the other as a great Director-General. As the Roll goes on—one's personal acquaintances (from a very humble position) increase very slowly, but the known names rapidly, till one reaches the period when the men one served under appear—and memories of companionship and occasional antagonism arise. Recollections of old stories, and the thousand and one incidents of one's life, revive—it suggests the tension of the Day of Judgment, which cannot be unmixed with Homeric laughter unless a sense of humour is essentially a bodily quality.

The pity of it is that no young officer can get the full value of the book, though every one should see what his predecessors have done. After all there were brave men before Agamemnon.

The book has been ably edited by Lieutenant-Colonel Howell, who shows how the work, incomplete at the time of Colonel Johnston's death, was carried on by his hands and by Colonel Peterkin, C.B., with assistance from others named.

Every Royal Army Medical Corps Mess and Library, and all Service Clubs should possess this Roll. R. J. S. S.

THE FITTING OUT AND ADMINISTRATION OF A NAVAL HOSPITAL SHIP. By Fleet Surgeon E. Sutton, R.N. Published by John Wright and Sons, Ltd., Bristol, 1918. Price 8s. Pp. vi + 110, $5\frac{5}{8} \times 8\frac{1}{2}$.

This small book on fitting out and administration of a Naval Hospital Ship is divided into four sections. Section I is historical and also gives International Law relating to hospital ships and the Geneva Convention. Section II gives in detail the conversion and fitting out of a typical hospital ship. These two sections are an excellent summary and guide on the points to which they refer.

Sections III and IV, comprising more than half the book, give details of organization. The embarkation and disembarkation routine are fully described as regards naval routine. As the rest of the book is applicable to hospital ships of the Army as well as the Navy, it is a pity that the Army routine of embarkation, disembarkation and distribution of the patients to various hospitals is not given, as it would have made the book of more general value.

ELEMENTS OF FIELD HYGIENE AND SANITATION. By Joseph H. Ford, B.S., A.M., M.D., Colonel, Medical Corps U.S. Army. London: William Heinemann, Ltd. 1918. Pp. 248, with Index. 8vo. Price 6s. net.

This book is a very useful addition to the library of practical war sanitation. Some of the methods and illustrations have been taken from Lelean's "Sanitation in War," but there is also much that is new. The last chapter on illustrative regulations concerning field hygiene and sanitation are worth issuing to every officer and senior N.C.O. in all Allied armies. The diagrams of constructional details at the end of the book should find a place in the Field Service Pocket Book.

The general text of the book is written to be understood by the combatant officer, and is full of practical suggestions. The work should be of considerable assistance to the sanitary officer in preparing lectures and giving instruction to effective troops. Photographs and diagrams are clear and well reproduced; the subject matter is well printed.

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Original Communications.

PHYSIOLOGICAL EFFECTS OF A PROLONGED REDUCTION IN DIET ON TWENTY-FIVE MEN.[1]

By FRANCIS G. BENEDICT.

From the Nutrition Laboratory of the Carnegie Institution of Washington, Boston, Massachusetts.

It is perhaps remarkable that with all the current discussion regarding food conservation, so little emphasis has been laid upon the possibility of conserving food by reducing the diet. When one recalls the agitation of enthusiasts for reduced diets during the past thirty years and recognizes the fact that all special pet theories can, at this psychological moment, obtain a better hearing than at any previous time, it is surprising that the advocates of reduced diet have made so little progress and, indeed, have apparently ceased their propaganda.

The popular conception that we eat too much is usually quantitatively expressed by the statement that we eat "twice as much as we ought." The Nutrition Laboratory has for years been endeavouring to discover if there exist any special groups of individuals who live regularly upon a diet that would be commensurately low. For this purpose it was assumed that the minimum or basal metabolism must be taken as the index of food requirement. Differences in muscular activity are so great that no two individuals can be compared save on an absolute quiescent, resting basis. After the metabolism of 200 or more individuals had been carefully measured, it was seen that, although we were dealing with people of varying ages, dietetic habits, and supposedly very low metabolism, no such individuals were easily recognized in our measurements. It would thus appear off hand, that if there are no individuals other than pathological

[1] Address given to the American Philosophical Society April 20, 1918.

which present abnormally low basal metabolism and if the law of conservation of energy in the human body obtains, as we know it does, then there is no *a priori* reason for expecting that a reduced diet can be permanently adhered to. A reduction in diet will simply mean that body reserves will be drawn upon until death from starvation occurs.

About a year ago I had the privilege of meeting Professor Alonzo E. Taylor in Philadelphia, when I received at first hand information regarding some of his important observations in Germany on the dietetic habits of the German civilian population. While there was no quantitative measurement of the food intake of these people, the fact appeared to be established without doubt that the Germans were subsisting upon a very low calorie intake and that this had endured for so long a time since the beginning of the war that it seemed highly probable that the former liberal body reserves no longer supplemented the diet. As a result of this conference a previously-formed plan was crystallized into definite action. After conference with my colleagues at the Nutrition Laboratory, an extensive research upon the influence of a prolonged reduction in diet on a group of men was outlined. Obviously much profit was derived from the criticisms of the historic research of Professor Chittenden with his group of soldiers. Professor Chittenden's problem dealt mainly with the nitrogen intake and output, but when the energy of the diet comes into discussion, it is clear that the dietetic control must be even more rigid and one must, in the last analysis, be wholly dependent upon the personal integrity and veracity of the subjects. If a person ate more protein than was allowed, this would show in the urine. A person could eat considerably more calories than actually allowed and yet no direct chemical control could be secured.

Through the kind offices of Professors J. H. McCurdy and Elmer Berry, of the International Y.M.C.A. College at Springfield, Massachusetts, both unusually interested in metabolism problems, arrangements were made to select twelve men out of a group of volunteers from the student body. The men entered heartily into the spirit of the whole research, and readily consented to all the strict requirements of the test.

It is a great pleasure to record that during the four months of experimenting there was not the slightest indication of any of these men wittingly or unwittingly violating even the strictest regulations of the research. The honour system obtains at the College; the men realized that they were in a position to do the nation a great service, and with the fidelity, enthusiasm, and high ethical spirit exhibited by the whole student body, these men went through the arduous four months without a serious complaint.

The general plan was to curtail the diet sufficiently to reduce the weight approximately ten per cent. This could have been done by a complete withdrawal of food for about fourteen or fifteen days. It was recognized that these men were, first, college students with obligations for educational advancement, and, second, volunteers for scientific research. A complete

fast for fourteen days would, in all probability, have caused most of them considerable discomfort, if not distress. The alternative was to curtail the dietetic intake so that the weight loss would take place, not in fourteen days but in four to six weeks. This was done by serving the men approximately one-half to two-thirds of the caloric requirements prior to the dietetic control, making absolutely no change in the kinds of foods eaten. The young men were cautioned not to lessen their mental or physical activities. Obviously if the activity of a group of men were lessened as, for instance, by putting them to bed, to use an extreme illustration, their dietetic requirements would be very much less. Suffice it to say that these men carried out all the requirements of collegiate activity, both physical and intellectual, throughout the entire period. As soon as the reduction in weight had reached ten per cent or thereabouts, the calories in the intake were increased to such an extent as to hold the weight at a constant level. The number of calories required to hold this weight constant over a considerable period of time could be taken as a fair representation of the actual caloric requirement for this group of men.

At the start we were confronted with the possibility of a seasonal variation. Thus, if one took a group of twelve active Y.M.C.A. students, at the end of a summer vacation, fresh from summer camps with their outdoor activities, and placed them in academic halls with restricted hours, artificial illumination and curtailed physical activity, it is conceivable that there would be a normal retardation of metabolism in the later fall months.

To insure a suitable base line, therefore, a second group of twelve men from the large number of volunteers originally presenting themselves were selected to act as a control squad. These men were in every particular studied with the same degree of care as Squad No. 1, except that there was no dietetic control.

While body-weight can be taken as an approximate index of the metabolic level, further checks were absolutely necessary to rule out the inevitable differences in muscular activity that would be found with groups of individuals, even when they were subsisting under the same collegiate conditions. The gaseous metabolism was therefore measured practically every morning for each one of the first squad. These measurements were made by collecting the expired air and analysing it. From the amounts of oxygen consumed and carbon dioxide produced, the basal heat output could be computed by indirect calorimetry, thus furnishing the second index of metabolic level. The pulse-rate was recorded simultaneously every morning. Every other Saturday night the entire group of men were taken to Boston and placed inside a large respiration chamber, where they could sleep comfortably. The carbon-dioxide excretion of the twelve men was thus determined simultaneously during deep sleep. This furnished a third criterion for judging the metabolic level.

The control squad showed no seasonal variation and their basal metabolism, as measured in the large respiration chamber in Boston, was

found to be absolutely identical with that of the first group of twelve men prior to the restriction in diet. To check the important findings with the first squad during the early period of the investigation, the second squad was later placed upon a very restricted diet for a period of three weeks, the diet given being less than one-half of their normal requirements.

For both squads, when on diet, the food for each day was carefully weighed, sampled, and analysed for the individual men. It is thus possible for us to measure the complete intake of protein and calories. The urine was collected throughout the entire time, and the fæces at frequent intervals. It is a tribute to the painstaking and conscientious co-operation of these men that throughout the entire period of four months, the urine was rarely lost. We thus have complete data for striking a balance between the nitrogen in the food and the nitrogen in urine and fæces.

Advantage was taken of each bi-weekly visit of the separate squads to the laboratory in Boston to put them through seventeen psycho-physiological tests. Although it was rather difficult to secure much evidence of introspection without the danger of suggestion, careful records of all the relevant observations on introspection were made.

The most important scientific findings may be summed up as follows :—

(1) A gradual reduction in weight to a point twelve per cent below the initial weight took place during a period of from three to ten weeks, with low calories and a moderate amount of protein in the food intake. The normal demand of the men prior to the dietetic alteration ranged from 3,200 to 3,600 net calories. One squad of twelve men subsisted for three weeks on 1,400 net calories without special disturbance.

(2) After the loss in weight of twelve per cent had been reached, the net calories required to maintain this weight averaged about 2,300,[1] or approximately one-third less than the original amount required.

(3) At the end of the reduction in weight, the actual heat output during the hours of sleep, as computed by indirect calorimetry, was approximately one-fourth less than normal, thus giving a rough confirmation of the lowered number of calories found by actual measurement of the food intake. That there was no seasonal variation in metabolism was shown by the constancy in the metabolic level of the control squad.

(4) The heat output by indirect calorimetry per kilogram of body weight and per square metre of body surface was essentially eighteen per cent lower than at the beginning of the study.

(5) Throughout the period of loss in weight and for some time subsequent thereto, there was a marked loss of nitrogen to the body. In round numbers these men each lost approximately 150 grammes of nitrogen. There is an intimate relationship between this "surplus nitrogen" and the metabolic level. Removing the "surplus nitrogen," we believe, distinctly lowers the stimulus to cellular activity.

[1] Subsequent revision has shown that the net calories required, averaged 1,950 rather than 2,300.

(6) The nitrogen output per day at the maintenance diet of 2,300 net calories was about 10·5 grammes. The control group of twelve men, living substantially the same life and eating in the same dining-room, but with unrestricted diet, showed a nitrogen output of fourteen grammes per day.

(7) The pulse rate was astonishingly lowered. Many of the men showed morning pulse rates as low as 33, and daily counts of 32, 31 and 30 were obtained; at least one subject gave six definite counts on one morning of 29.

(8) The blood pressure, both systolic and diastolic, was distinctly lowered.

(9) The skin temperature, as measured on the surface of the hands and forehead, was, with some subjects, considerably lower than normal. With most of the men normal temperatures prevailed.

(10) The rectal temperature was practically normal.

My colleague, Dr. Walter R. Miles, found as a result of numerous tests of the neuro-muscular processes that there was no material change as a result of the reduced diet. There was a very slight falling off in the strength tests with the hand dynamometer.

As one of the best indices of muscular performance my associate, Dr. H. Monmouth Smith, measured the energy required by each man to walk one mile in about twenty minutes. With a reduced diet, the requirement was found to be lower with all the men than with a normal diet, this being due, in part, to the fact that the reduced weight meant a lower weight to transport. In other words, these men walked a mile with noticeably less energy consumption than a man not subsisting on a reduced diet.

The subjective impressions were almost uniform that the muscles in the thigh were distinctly weakened. The men complained of difficulty in walking upstairs, but our personal observations go a long way towards refuting this, for all the men seemed able to go upstairs two steps at a jump on several occasions. On February 1, 1918, at Springfield, after four months on diet, eleven of the diet squad were pitted against eleven men from the College body in an arm-holding contest for endurance. The arms were held extended, palms down, at the level of the shoulder. The number of men falling out were practically the same in both squads; as a matter of fact, seven in the diet squad and eight in the uncontrolled squad held their arms out for one full hour.

Two of the men had chronic bad noses. One was operated upon during the test and the other should have been. Aside from these two, the prevalence of colds during the period was about the same as with the other college students. During the study three men underwent ether narcosis for operations (on nose, foot and hæmorrhoids) and made rapid recoveries. One man at the lowest period of weight became infected with typhoid, ran through a course of very high fever, and was critically ill for some time; he has made a complete convalescence and recovery and has returned to college.

The most noticeable discomfort experienced by the subjects was a feeling of cold, which it is only fair to say might be due in large part to the severity

of the past winter. In general, notwithstanding the very great reduction in the metabolism, which we believe was due to the removal from the body of the stimulus to cellular activity of approximately 150 grammes of "surplus nitrogen," the whole period of lowered food intake had no untoward effect upon the physical or mental activities, and the men were able to continue successfully their college duties.

When the second squad was put upon a restricted diet, the picture exhibited by the first squad was strikingly duplicated in all details, although, as the loss in weight was obviously not so great with the second squad (six per cent as compared with twelve per cent), the phenomena were quantitatively somewhat less emphasized.

At the conclusion of the entire research the men presented an appearance not unlike the average college student; it would have been difficult to pick them out from the rest of the college body on the campus. On close inspection the members of the diet squad would perhaps have appeared somewhat emaciated, particularly in the face, but they were performing their duties as college students, both physically and intellectually, with no obvious reduction in stamina. No words can express their exact condition at the end of these tests so clearly as a short section of motion picture film, showing the general agility, spirit and physical ability of these men.

The great objection to making practical deductions from laboratory experiments is usually that such researches are carried out on the lower animals, or if men are studied but one or at the most two men are used. With a group of twenty-five men, such as was studied in this research, one is justified, if ever, in drawing deductions or making recommendations.

In addition to the fact that we have experimental evidence based upon twenty-five men from which to draw conclusions, we have also the fact that this is a period of stress, a period of innovation, a period for trial, for experimentation, for "taking chances," if you will. These combined factors are based, first, upon the large human experience of enforced diet restriction in Germany; second, upon the psychological set of the patriot; and, third, upon the moral obligation laid upon us all to contribute to the vast project of food conservation.

We cannot, then, be charged with faddism or irrational propaganda if we are led to make certain definite recommendations—recommendations that admittedly we would never make in peace times and that admittedly may have serious faults. These recommendations are primarily a war measure. In time of peace and plenty, the physician would rightly caution against an undue adjustment of the diet or fundamental alteration in dietetic habits. Still, when millions of our allies and hundreds of thousands of our own people are jeopardizing their very existence, it is not the time to talk about the possible dangers of moderate or even considerate changes in diet. With a large number of individuals, it may be of real psychological benefit to realize that they may, by personal diet restrictions, introduce an element of hazard into their lives, slight though it may be. No one could

look at those vigorous young men, carrying out their college work, examinations and physical activities in competition with their classmates, and not be impressed by the fact that the danger, if any exist, must be extremely remote.

As an index to the rather remote probability of danger, one should be reminded that the modern treatment of severe diabetes is essentially founded upon a lowering of the basal metabolism. Dr. Allen's diabetics, practically wrested from the jaws of death, present a remarkable picture. The curtailment in diet, with the low stimulus to cellular activity, has certainly in their case been a life-saving benefit.

A research of this kind offers almost unlimited field for speculation not only in pure physiology but likewise in its practical applications to everyday life. We believe it was made with a sufficient number of men to rule out the personal equation. Indeed, the individual picture presented by each man is strikingly uniform with the general picture presented of the group. There are no exceptions.

I find myself in a novel situation as a public advocate of far-reaching dietetic alterations. Recalling my earlier objections to Professor Chittenden's inferences from his experiments, I realize that, although abstract science and propaganda are more or less incompatible, in time of stress old beliefs may well be challenged, earlier concepts discarded, and conservatism permitted to exercise a less restraining influence; hence a public avowal of change of point of view and an admission of the errors of earlier judgment are not only desirable but absolutely necessary. While still maintaining that the published records of Professor Chittenden's experiments left the desirability of a propaganda for lower protein and energy open to serious fundamental criticism, I am now convinced that his data on protein intake justified many of his public statements and recommendations. His conjectures regarding caloric needs seem in no small part substantiated by the results of this new research.

Although some of our men were under 21 years of age, the data obtained in our experiments have no bearing on the period of growth; the diet of the growing child should under no circumstances be reduced. Neither are the results applicable to the conditions of severe muscular work as, for example, in the Army. They may, however, legitimately suggest practices for patriotic civilians not performing severe muscular work; that these standards represent the optimum needs for peace times requires further evidence for substantiation. It is quite clear that a civilian body of men could readily withstand a siege on half rations without difficulty for several months, and since danger seems remote, that reduced rations for all adult civilians may be justifiable as a war measure for a relatively long period of months. Professor Chittenden's conclusions from his experiments that a low-protein diet is practicable seem fully substantiated; this expensive source of food material may thus be materially lowered. The calories may also, without doubt, be lowered. Indeed, it may become a serious question

as to whether a patriot should be permitted in times of stress to carry excess body-weight, for the expense of carrying it around calls for calories that other people need. The excess weight is *prima facie* evidence that he is living at the highest metabolic level, higher than he needs by approximately twenty-five per cent, and there is no doubt that the excess weight contributes to shorten life.

Certain practical points in connexion with a reduction in diet are important. Difficulties in the shape of tendency to constipation can be easily controlled by the use of bran, as was done in our study. Bran also provides a certain amount of bulk which helps materially in producing a feeling of satiety. It is quite clear that variation in diet is absolutely essential. If a person craves a certain article of food, he may eat it, but stick religiously to the "half portion." The presence of an unlimited food supply on the table makes self-denial harder.

Of special significance is the importance of not eating between meals and of omitting the eating of extras. It has surprised us to find how large a proportion of the total diet is made up of these extras. Captain Gephart, in his study of the food intake of St. Paul's School, Concord, New Hampshire, found that out of a total daily intake of 5,000 calories per boy, 647 calories were derived from extras in the form of sweet chocolate, candy, coffee, buns, &c. With our control squad at Springfield when on normal diet, approximately 4,000 calories were consumed daily by each individual. Of this amount about 400 calories were obtained from extras not served at the table.

This is no time for the epicure. Every person should be under rather than over weight, and it should be popular not to be fat. To-day every woman as well as man should make it a special mission to see to the physical condition and not carry around excess fat or live upon an abnormally high metabolic level. By this means a great saving of food in this country can be effected to the positive advantage of health. It is more than probable that with reduction in flesh, the physical appearance will be somewhat less satisfactory, for admittedly the face may appear somewhat drawn. On the other hand, it is absolutely proved that excess weight is distinctly disadvantageous to health. People who are over weight are notoriously bad insurance risks. Even those overweights without demonstrated organic change in early or middle life show very high death-rates. Nobody should be over weight; most people should be somewhat under rather than over weight. If, when the war is ended, plenty is established and the need for restriction is removed, one wishes to go back to the former metabolic level, the way is very clear. The palate will lead to this way very readily. The purse may permit indulgence but the health may really be better for a moderate reduction.

We, who are far from the misery, trials and torments of the battle-field, are asked to restrict our diet intake, not only qualitatively (which Mr. Hoover and his associates have so wisely educated us to do), but quan-

titatively. It has been a fact, and a noticeable fact, that our most intelligent and best American men and women have been eager and anxious to do all they could, even at this distance, for the sake of the great cause. In this land of plenty it is highly improbable that positive measures calling for actual calorie restrictions will have to be passed, although this is by no means an impossibility. Here, as with all conservation measures, the volunteer is the first to take action. Let no one (particularly if he be over weight) complacently say that he has done his share until some positive action for food restriction has been taken. Fortunately no special chemical analyses, no calorimetric devices, no physiological measurements, are essential for the control of this factor. One has but to lower the body weight gradually ten per cent and adjust the food eaten to hold it at this level. The reduction in weight should cover a period of probably two to three months. It could be done in a considerably shorter time. When the weight is once lowered, and the calorie intake adjusted to holding the weight at that level, the patriot may feel assured that he or she is really making some positive contribution toward food conservation, and making it possible to send liberally to our Allies and to our own men much-needed supplies.

I cannot feel that an alteration in the Army diet is justifiable at present. It is bad policy "to swap horses in the middle of the stream." The fighting unit may well be exempted from innovations, but let the civilian population give this whole project a thorough, honest test, recognizing that while there may be, in certain cases, an element of hazard and in many cases an element of discomfort, the possibilities for danger in accomplishing a weight reduction of ten per cent are negligible. The calories thereby saved are by no means negligible, but with the sum total of our population would feed an enormous army.

TWO YEARS OF WAR SURGERY IN MALTA AND THE MEDITERRANEAN.

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The surgical experiences of the present War have varied so widely in different areas and at different times that it is difficult to obtain any complete view of the problems which have been presented from time to time and from place to place and, as the conditions of work in Malta were in some respects very different from those in France and elsewhere, it has appeared to me that it may be useful to summarize the impressions gained and the lessons learnt in the Mediterranean from August 1, 1915, to the middle of September, 1917. During this period, except for occasional visits to Mudros and Suvla and excepting for the winter of 1915-16, which I spent at Salonika, I was fully occupied as a consulting surgeon in the Base Hospitals of Malta to which my remarks will refer almost entirely, while the following summary is intended not so much as a contribution to surgery as to surgical history.

In order to appreciate the nature of our work it may be useful briefly to call attention to the climatic conditions of Malta as well as to the nature of the hospitals, which were very differently evolved and administered from those of England and France. During the summer months the temperature is high and the heat is somewhat severely felt by northern Europeans. Although the thermometer in the shade rarely if ever reaches 100° and is more commonly between 80° and 90°, the air is extremely damp, especially during the prevalence of the "shirok" wind, and it is at least uncomfortable to work or to be out of doors during the hottest part of the day, the discomfort being increased by the almost entire absence of shade. During the winter months on the other hand the climate can only be described as mild, but it is very rainy and damp, while the construction of the buildings and the absence of heating arrangements make the evenings feel decidedly cold. The most noticeable feature of the climate is, however, undoubtedly its dampness, which intensifies all variations of temperature and more especially makes the hot summer nights very oppressive. These discomforts are increased by the prevalence of mosquitoes and especially of sandflies, those who are not acclimatized suffering a good deal from their bites, while "sandfly fever" is not uncommon. The drainage and other sanitary arrangements are good and the water supply fairly satisfactory but all the water used for drinking has to be boiled or otherwise sterilized. Fruit and vegetables cannot be safely eaten unless skinned or cooked as they are liable to be infected with dysentery. Malta fever or *melitensis* as the inhabitants naturally prefer to call it, is now practically unknown among

the British, who use only tinned milk, but it is still endemic among the civil population.

In spite of the quite definite discomforts referred to, the island cannot be called unhealthy, and we had no great amount of trouble with endemic diseases except in the case of dysentery, which could be avoided by care in dieting and by protecting food from flies. Malaria does not appear to exist as an endemic, and such infections as cholera, plague and the other dangers of the Near East are only rare and occasional visitors. Typhoid and paratyphoid fevers were met with from time to time, but were under full control, and certainly could not be regarded as affecting the choice of Malta as a hospital base. It may however be of some importance to those at home dealing with men who have been in the island to remember that we had a few cases of kala-azar.

The mildness of the climate was of considerable advantage in so far as it allowed many of the wounded to be treated in the open air, and balconies could be freely used for this purpose, while we were able to occupy buildings which in a more northern climate would hardly have been warm enough or sufficiently weather-proof. In such respects Malta is distinctly a favourable place for surgical cases; on the other hand, although immediate operation results were as good as in England, the enervating nature of the climate was apt to prolong ultimate convalescence and there is a sad lack of the general moral and hygienic effects summed up under the expression "change of air."

In peace time and during the first nine months of the War the military hospital accommodation of Malta was limited to the needs of the garrison, and excluding the naval hospital at Bighi, consisted of about 300 beds. In September, 1914, the already depleted regular staff was reinforced by the addition of a London Field Ambulance under the command of Colonel Sleman, but it was not until the commencement of the operations in the Dardanelles in April, 1915, that it became clear that a very great extension of accommodation and staff would be required. This accommodation had to be built up from local resources and by the dispatch from England of individual medical officers, no intact units ever having been sent to Malta except for short visits on their route to the East. With the building up of this organization the writer had little to do, and in all essentials it was completed on his arrival in the island.

In the spring of 1915 there were available for hospital purposes the original station hospital Cottonera, the old and often condemned Valetta Hospital of the Knights of St. John, various large and fairly modern barracks, and certain civil buildings such as schools and a few of the old Auberges. To these were added camps and some huts and in August of 1915 we had accommodation for 7,044 patients. The actual number of available beds has however since varied greatly; in March, 1916, when the needs of the Gallipoli campaign had been met, it amounted to 13,500, and was reduced to 12,000; in October, 1916, owing to the demands of the

Salonika force the highest figures were reached and we had 25,570 beds and 20,994 patients, but hereafter the numbers began to fall until when I left Malta there remained only 5,943 patients many of whom were convalescent. To the end of August, 1917, the total number of men treated in Malta was about 125,000, and of these approximately equal numbers came from Gallipoli and from Salonika, the great majority of serious surgical cases being in the former category.

The hospitals themselves, of which there were at one time 24, were variously located and varied also in the extent of their accommodation, but in August, 1915, the station hospital of Cottonera had 374 beds and that of Valetta 400 beds; 685 beds were in civil buildings such as schools and auberges; 3,589 were in stone-built barracks; and 1,996 were under canvas. The great majority of these hospitals were provided with operating theatres and as far as possible surgical cases were kept in stone buildings or transferred thereto for operation. An X-ray apparatus was provided in all the more important buildings. Most of the laboratory work was carried on in centralized laboratories, but the important surgical hospitals of Cottonera and Tigne and the isolation hospital of Imtarfa had each their own fully equipped pathological departments. Some difficulty occurred from the delay in obtaining medical stores from England, but by comparison with other bases I think we suffered extraordinarily little in this way and the greatest help was given to us by the officers of the Ordnance Department, who made not only nearly all our splints, but even surgical instruments of complicated pattern.

The staff of medical officers, consisting in the first instance of some half a dozen of the R.A.M.C., with the London Field Ambulance, was increased by the addition of medical officers of the local militia and by that of civil practitioners, as well as by drafts from England and a certain number of those returning from Serbia or going to Egypt. In the autumn of 1916 we also obtained the services of about 100 medical women, who carried out all but administrative duties and whose assistance cannot be too highly appreciated. The majority of the hospitals were under the command of territorial or temporarily commissioned officers, and practically all the divisional officers and medical and surgical specialists held temporary commissions; in spite of this no serious difficulty was found in connexion with the administration, but the small size of the whole command allowed of constant supervision by the successive Directors of Medical Services, Colonel Sleman and, after my arrival, Surgeon-Generals Sir Hayward Whitehead and Sir Thomas Yarr. Much of the smooth working of the whole command was also due to Lieutenant-Colonel Cumming, who was stationed in Malta before the War and who remained until the work had greatly diminished. The controlling figure throughout was however the Governor, Field-Marshal Lord Methuen, whose personal magnetism, deep sympathy and extraordinary interest in and knowledge of medical matters, combined with almost unlimited authority, smoothed away difficulties,

overcame the resistance of regulations little adapted to the peculiar conditions, and probably alone made possible the harmonious working of so many diverse elements.'

The consulting physicians[1] and surgeons[2] carried out their duties much as in private practice at home, and were less of the nature of inspecting or liaison officers than they are in France.

After the early days of the Gallipoli campaign the surgeons performed personally nearly all the more serious operations, and we had the advantage, not obtained in most military areas, of being able, and indeed obliged, to retain our cases for considerable periods and thus to observe results. New methods of treatment could not be taken up quite so quickly as in stations nearer home and new drugs and apparatus were not so readily available, but there was probably a correspondingly less tendency to adopt such new methods on slight evidence, and a somewhat more critical attitude towards novelties. In addition to consulting and operating, a good deal of time was occupied in instructional work and occasional courses of lectures appeared to be regarded as of value by medical officers of limited experience. During the winter months a fortnightly "conference" gave a valuable opportunity for the interchange of ideas, and as nearly every branch of medicine was represented by some specially qualified practitioner, these meetings were of the greatest value to all of us.

Having said so much as to the general conditions of work in Malta, we may also note that the nature of the cases which we received for treatment varied much during two years, and may be roughly considered as falling into three periods or phases. (1) From the spring of 1915 to the end of that year the vast majority of patients were from Gallipoli; the conditions of the campaign on the peninsula called for rapid evacuation, and allowed of very little surgical aid before arrival in Malta, while a voyage of several days had to be endured by even the most gravely injured; under such conditions wounds arrived in an advanced stage of sepsis, and we were at times almost overwhelmed with cases of the most serious nature. Towards the end of the "Gallipoli period" disease became more prominent than wounds, and in the closing months, except for a group of cases of frostbite, the surgical casualties were not in excessive numbers. The last of the Gallipoli patients were evacuated in the spring of 1916. (2) The Salonika Expeditionary Force did not begin to send many sick to Malta until the end of 1916, and owing to the existence of efficient base hospitals in Salonika itself, the surgical cases never arrived in so acute or so serious a condition as those received from Gallipoli. On the other hand, the summer of 1916 provided a large number of "medical" casualties, and among these were many requiring surgical treatment for sequelæ or for intercurrent affections. (3) After the autumn of 1916, for various reasons to which no

[1] Colonels Purves Stewart, Gulland, Garrod, Tooth.
[2] Colonels Ballance, Charters Symonds, and the writer.

reference need here be made, the stream of work from Salonika also gradually diminished, and finally during the summer of 1917 surgery became largely such as is incidental to the considerable population constituted by the garrison, by convalescents, by passing transports, and the like.

Having thus dealt with the general situation in Malta, we may now turn to the consideration of the surgical work there, it being clearly understood that in the following notes I can give only my personal experiences and impressions, and that these in no way represent the views of any of my colleagues, who may or may not agree with my conclusions.

Aseptic operations were carried out as readily and with results as satisfactory as in England, but a few special precautions had to be observed. The heat of the operating rooms caused free perspiration on the part of both patient and staff, and care had to be taken to avoid soiling the wounds from this source. As the wearing of a mask covering the whole face was to me at any rate very exhausting in hot weather, I dispensed with these and preferred to wear a skull cap, having a piece of cotton wool tucked in under the forehead so as to absorb the perspiration. For such operations, however, as the removal of semilunar cartilages, I employed the mask which I prefer at home, and which consists of a skeleton pair of spectacle frames having no upper rim in the place which the lens would occupy; over this is hung a piece of gauze folded eight times, broad enough to cover the whole lower face and long enough to fall well down into the apron, which holds the gauze completely over the nose and mouth ; by this device, introduced some years ago by my late house surgeon, Colonel Webb-Johnson, the breath is completely filtered or deflected well to the sides, and is not, as with many half masks, either deflected down on to the wound or allowed to escape from the uncovered nose. In the hottest season it was found comfortable to strip completely before operating, putting on merely a cotton suit of a jacket and a pair of trousers. The provision of rubber gloves presented some difficulty, as they were very liable to perish rapidly, but it was found that they could best be kept in good condition in an ice chest.

The preparation of the *patients' skin* also required some care, as it was apt to be very moist and not rarely to present inflamed insect bites. I was never quite satisfied with alcoholic iodine as a disinfectant, and I much preferred to clean the part with turpentine, followed by a 1 in 500 alcoholic solution of biniodide of mercury; the skin was then finally dried with ether and alcoholic iodine was painted over it. Small suppurating foci were often touched with the Pacquelin cautery before the operation was commenced; gauze was attached by clips round the edges of the wound as soon as the skin had been divided, and any exposed flaps were similarly protected. In spite of all these precautions, which are of course usual even in British surgery, but which require emphasis in Malta, suture abscesses

were not uncommon, nor was it rare for such small abscesses to develop after the sutures had been removed, especially in the case of large wounds of the lower limbs, such as those required for the removal of varicose veins or for the plating of simple fractures. Fortunately these drawbacks were technical rather than important, and I never saw infections spread below the skin; it appeared to me that in the majority of the cases mentioned the infection occurred after rather than at the time of the operation, and that it was due to the accumulation of perspiration under the dressings—which moreover we had to make as small and light as possible. I had occasion to perform many excisions of semilunar cartilages, operations for varix and varicocele, and such operations as appendicectomy, gastro-enterostomy, sigmoidectomy, hysterectomy, ovariotomy, decompression for cerebral tumour, nerve suture, ligature of arteries, and plating of simple fractures, and I had only one case in which deep suppuration ensued, nor do I know all the circumstances of this case (plating of a tibia) as I left the island before the sutures were removed. I understand that the Maltese surgeons avoid as far as possible operating in the very hot weather, but, apart from the general inconveniences and necessity for a little extra care, I see no reason why, if assistants are properly trained (which was by no means always the case in our work), aseptic surgery should not be carried on throughout the year as in England.

Turning to the question of *septic wounds*, it has been already indicated that those received from Gallipoli were often in a most serious condition, as many of the patients had been transferred from the first dressing stations to hospital ships in which they had to remain for a good many days before we received them. Under such circumstances, as in all military surgery, the use of antiseptics was a constantly debated question. Before my arrival the solutions principally used were, I believe, those of carbolic acid and lysol and the mercurial compounds, hypochlorous acid not yet having been introduced. Within a very short time after I landed Professor Lorrain Smith communicated to me his work upon "eupad" and "eusol," and I devoted a good deal of time to comparing these with other antiseptics. The dry preparation of eupad—a mixture of equal parts of bleaching powder and boracic acid—was introduced into drainage tubes, and was used in gauze bags; but I soon came to the conclusion that it caused the formation of too abundant grey and œdematous granulations, which interfered with drainage, and which, if deeply seated, embarrassed the circulation, so that the use of this powder was soon abandoned. Eusol, on the other hand, was very freely used, and soon demonstrated its popularity. By comparison with other antiseptics I was never able to satisfy myself that it had any great advantages beyond economy and absence of any risk of poisoning, although on the other hand it appeared to be at least equally effective. I preferred to have the solutions made isotonic, and in not a few cases they were used with sodium chloride as a hypertonic solution either in baths or for irrigation. In all cases in which eusol was employed

the protection of the skin was even more important than in cooler countries, and for this purpose firm painting with liquid paraffin on a camel-hair brush is decidedly superior to the use of gauze smeared with vaseline; the paraffin is sterilized by placing the bottle in a water-bath and boiling the water for some twenty minutes, while the brushes are kept in ether and dried before use. If by this means the solution be firmly rubbed into the skin, around and close up to the edges of the wound a very impervious coating is produced, beneath which discharges cannot penetrate as they are liable to do with vaselined gauze. The Carrel-Dakin method of using hypochlorous acid was not employed in Malta until the spring of 1917, and as the number of septic cases had now become comparatively small, we had few opportunities of comparing it with our earlier methods. Cases arriving from Salonika with Carrel's tubes appeared on the whole to be in rather better condition than those otherwise treated, but any deductions founded upon such evidence would be fallacious in the absence of an exact knowledge of the conditions then prevailing in the Salonika hospitals and influencing their evacuation. The very great majority of our cases were on arrival of too old a date for much to be expected from the use of Rutherford Morison's bismuth and iodoform paste, although in some few instances we found it of great value, sinuses and pus collections being opened up, smeared with the paste, and then closed with rapid healing; in one case only the free use of the paste, in a case of extensive sinuses connected with a compound fracture of the femur, caused serious symptoms, but in this instance the paste was not merely smeared over the surfaces but packed in in bulk. Some of the newer antiseptics such as brilliant green, flavine and dichloramine-T were not obtainable in Malta up to the time of my departure.

Very considerable use was made of saline solution, both isotonic and hypertonic, and in many cases—especially after operations for sequestrotomy—we introduced solid sodium chloride and citrate into deep recesses of joints or the fractured ends of bones, but again I find it impossible to say that the clinical results were distinctly either better or worse than those obtained by the use of antiseptic solutions. I was however much impressed with the rapid healing and absence of complications in severe wounds received while the sufferers were actually immersed in salt water, that is to say, in those who, being on torpedoed vessels, were injured after or immediately before having been thrown into the sea, but most of these wounds were due to being struck by debris, and it is not possible to regard them as on the same plane with gunshot wounds.

Peroxide of hydrogen was freely used for dressings until, towards the end of our period, it became difficult to obtain. Its one great advantage over other solutions is the facility with which it loosens adherent dressings, but for purposes of irrigation of wounds which are not plane surfaces, it should, I think, be strongly deprecated, as it opens up sinuses without having any reliable disinfecting action, is hence often exceedingly painful

and disturbs the granulation tissue in its efforts to close sinuses and cavities.

I have dwelt at some length upon these questions as they have given rise to so much debate in England and France, and as we had exceptional opportunities for prolonged observation of our cases. The one outstanding conclusion however at which I arrived is that the nature of the dressing or lotion used made but little, if any, difference, and that (apart from early cleaning and excision of wounds, which we could not practise in Malta), the essential conditions are thorough drainage, the continuous search for and immediate opening of new tracks and pockets, care and gentleness in handling granulation tissue and newly-formed fibrous tissue, and the avoidance of all unnecessary surgical interference (including probing and washing out or *in*) during the long period of septic inflammation. It is impossible to over-emphasize the importance of gentleness during dressings, especially when, as in much military surgery, these are performed by imperfectly skilled hands, and in this connexion I am afraid that not enough use is made of non-adherent coverings for the granulating surfaces. For such covering thoroughly perforated oil-silk is most valuable, although but little used; christia, which is supplied as a cheaper substitute, is decidedly inferior and liable to soften and curl up. The perforated celluloid recommended by Captain Douglas I was unable to obtain in Malta except through private sources; for covering flat surfaces it is admirable, but I was unable to soften it sufficiently for irregular surfaces, and I could not satisfy myself that it had any real value as splinting and immobilizing the soft tissues; some perforated wax paper supplied from home as a substitute became too soft to have any real value, and tended to stick to discharges. In order to diminish the pain of wound dressing nikalgen was tried, but was quickly abandoned as not appearing to have any real value; apart from this it would appear that any form of local anæsthetic is of doubtful benefit as it only masks pain, does not actually protect the surface from mechanical injury, and hence tends to encourage the very roughness which it is so important to avoid. If sufficient care and time be given the dressing of most wounds need cause little pain, and apart altogether from local conditions, much mental strain may thus be avoided, for which reason I would again emphasize the importance of thoroughly greasing the skin with liquid paraffin and covering the wound with a thoroughly perforated non-adherent material. As to injury of young cicatricial tissue either by incisions or still worse by bruising, it has to be constantly borne in mind that every surgical procedure in such tissue opens up new lymphatic and vascular tracks and increases the difficulty which the tissues find in disposing of micro-organisms; hence it was necessary constantly to discourage premature attempts at removal of foreign bodies or sequestra and to insist on the fact that micro-organisms remain buried in granulation tissue long after acute septic conditions have subsided. As an illustration of the danger run in dealing with recently inflamed tissues I may mention

the case of a lad who, in addition to having a healed wound of the thigh, required a re-amputation of the leg. The amputation gave no trouble, but a large abscess promptly developed in the thigh, and could only be attributed to the pressure of the tourniquet on the recent scar. Numerous cases were also seen in which quite slight operations for sequestrotomy in a late secondary period were followed by sufficiently serious results.

Passing to the *special infections of wounds*, we find little of importance to note. Gas gangrene was never common after my arrival in Malta, possibly because infected cases were unable to bear the journey from Gallipoli, but more probably because the uncultivated soil on which the campaign was fought did not tend to be so highly infected as that of France. Similarly, during the winter which I spent in Salonika, I saw but one case of gas infection of a comparatively mild type, although I am aware that others were met with. Tetanus also was uncommon even in 1915, and I saw only about half a dozen cases with one death. The fatal case was admitted from Salonika in the spring of 1917, with an amputation at the shoulder joint, which had been completely healed for at least three months. The patient was apparently quite well when he was suddenly attacked one morning with violent pain in the stump; I saw him on the following day, when he had typical tetanus with opisthotonus, and although treated at once with large doses of serum both intravenously and intrathecally, he died within about forty-eight hours of the onset of the pain. On investigation we found that at Salonika he had had a gas infection, that tetanus-like organisms were found in his wound secretion, and that at least four or possibly five injections of antitetanic serum were there given hypodermically. Among special infections may perhaps also be mentioned the *Bacillus pyocyaneus*, which during the early part of 1916 was very frequently met with in Malta; as in other areas its presence seldom appeared to be of serious import, and I almost came to regard it as of good prognosis in suppurating wounds.[1] In Salonika I also saw several cases of anthrax within a short period during the winter of 1915-16, but we were unable to trace these to any common source, and at a later date I saw none in Malta.

A review of the general surgical conditions in the Mediterranean would be incomplete without some reference to the question of *shock*. Among the cases arriving from Gallipoli the general depression and the tendency to surgical shock was often extreme, many of the wounded having been previously exposed to most arduous conditions and subsequently to the voyage, for which not all were equipped by nature or habit, while probably long deprivation of a sufficiency of drinking water increased their prostration. In these cases the provision of abundance of fluid was important and

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[1] The same point has been recently referred to by Kellock and Harrison, and may be due to the *Bacillus pyocyaneus* serving to displace other and more dangerous organisms, as is suggested for the "Reading bacillus" of Donaldson and Joyce.

operations had to be undertaken with the prospect of very considerable shock, for which suitable precautions, such as the intravenous injection of saline solution were essential.

At a later period such severe cases were not met with and operations on reasonably healthy patients were associated with peculiarly little shock, probably owing to the high atmospheric temperature; in no one of many operations for abdominal diseases did shock give me the slightest anxiety.

Having thus noted some of the general conditions of surgery in Malta, a short reference may be made to wounds of various regions of the body, and, although the numbers of cases seen are insignificant in comparison with those met with in France, these allow of a few deductions which have the advantage of being founded on a longer period of continuous observation than is possible in the French hospitals.

Having regard to the conditions of transport it was inevitable that during the Gallipoli campaign *head injuries* should arrive in bad condition. At a later date they became comparatively rare, the majority no doubt being treated at Salonika, although it is noticeable that no very large number of convalescents arrive thence in Malta. During the autumn of 1915 most of the serious perforating injuries of the head were admitted to Baviere Hospital, where I was able to obtain some definite if not extensive statistics, which may be taken as fairly representing my experience in other hospitals. Of 33 cases admitted to Baviere, 15 died, and 18 were sufficiently recovered to be sent to England, which implies that they had recovered *quoad vitam* but by no means necessarily *quoad sanitatem*; of those which died the majority were obviously in a hopeless condition on admission, and all the deaths were due to general meningitis. Eleven cases had been operated upon before arrival and among these the most noticeable feature was the association between wound-sutures and mortality; 5 died and 6 lived; of the 5 fatal cases 4 had sutured flaps and 1 a large hernia; of the 6 which recovered none had been sutured. Judging from these and general observations of other cases which passed through our hands, it was clear that flap operations with suture of the flaps were in the Mediterranean almost invariably fatal, and in two years I saw only one or two cases leave Malta alive. On the other hand, and apart from the nature of the injury, cases not thus closed presented much better results. Twenty-two cases of compound fracture of the skull had not been operated upon before arrival and 2 others were obviously incompletely treated, so that 24 in all required surgical intervention in Malta. The rule adopted was to operate on all these cases, however hopeless the condition might appear to be; thus 7 presented definite symptoms of general meningitis on arrival and the total results were naturally not statistically good, although probably a good many were saved which would otherwise have died. Of the 24 cases 11 died and 13 were sent to England; of the 11 deaths 7 had general meningitis at the time of operation and 2 were smashes of the parietal region of at least

the size of the palm of the hand. Of the 13 recoveries all had depression and fragmentation of the inner table of the skull, in 9 the dura mater was perforated, in 3 others we found an extradural abscess, a subdural abscess, and blackened dura mater with blood-clot external to it, while in 1 only were the meninges uninjured. One of the cases which recovered had general meningitis in addition to hemiplegia due to his focal injury.

In all these late and very septic cases I used tri-radiate or longitudinal incisions passing through the original wound, and no attempt was made to made flaps as aseptic healing was obviously impossible; for the same reason no sutures were used. The scalp was cleaned as thoroughly as possible, and throughout the operation the area was freely douched with a solution of perchloride of mercury; at its conclusion all exposed tissue was washed with ether and as a first dressing I used gauze soaked in ether, eusol being generally employed afterwards, although alcohol or a watery solution of formalin were both employed in many cases and alcoholic solutions were preferred in all cases of hernia. It was very noticeable that in those cases left open hernia cerebri was not common and a little consideration will show that in the presence of extensive sepsis closure of the wound could only do harm, and that it is wiser to allow granulation tissue to protrude than, fearing such protrusion, to close the aperature and thereby increase the intracranial tension and eventually produce a larger expulsion of brain substance.

With regard to the mortality of these cerebral injuries it is interesting to note the extreme importance of region in determining the prognosis. Dividing the skull roughly into three areas—the frontal, parietal, and the occipital—we find that of frontal injuries all (6) recovered ; in the parietal region there were 8 deaths and 6 recoveries ; and in the occipital region there were 3 deaths and only 1 recovery. Similar ratios have been constantly noted in the past and are thus merely confirmed, while conversely they assist us in confirming the general accuracy of the deduction from the few figures here given.

Injuries of the *spinal cord* arrived only in small numbers and, as the very great majority of those which we saw were obviously hopeless, we made every effort to send them to England and operative treatment was rare, there being but two cases in which I thought it advisable to perform laminectomy ; in both of these the operation was unfortunately late, but in one it probably saved the patient from the worst results of his injury, while in the other it failed to relieve the pain for which it was undertaken.

Pte. A. S. was wounded in Gallipoli on June 11, 1915, but only came under my care in the following August. He presented a complete flaccid paralysis of the lower limbs with paralysis of the bladder and rectum and anæsthesia nearly to the level of the groins. The radiogram showed a shrapnel bullet lying in the spinal canal opposite to the body of the second lumbar vertebra and it was clear that the cauda equina was compressed if not torn by it. Two operations had already been performed without

discovering the bullet and naturally without relief. As the patient was suffering intense pain I exposed the affected region and found the bullet lying slightly to the right of the middle line and opposite the upper part of the second lumbar body. The left side of the cauda formed a dense cicatricial mass, while on the right was a gap in the cicatrix occupied by the bullet. There was, of course, no difficulty in removing the latter but it was impossible to dissociate the matted nerves and the extent of the scar rendered resection and suture impossible, so that I was only able to bring together with catgut the gap left by the removal of the foreign body. A year later, I heard that this patient was still suffering intense pain and it would seem useless to hope for recovery at any later date; probably the best course would now be to excise the whole scar and aim only at relief of pain, but an earlier operation would have given good prospects in a case of this type.

Pte. E. R. was admitted from Salonika, coming under my care about three weeks after he had received a bullet wound of the back 2½ inches to the left of the third dorsal spinous process; the wound was nearly healed and a radiogram showed a shrapnel bullet lying to the right of the vertebral column over the fifth costo-vertebral joint on its dorsal aspect. The track of the bullet was indicated by a slight deposit of lead on the fifth dorsal spinous process. This patient presented complete paraplegia of the trunk and lower limbs with retention of urine, loss of knee-jerks, ankle-jerks, and plantar and cremaster reflexes; but retention of the superficial abdominal reflexes; anæsthesia involved the legs, thigh and trunk to the level of the seventh rib on the left and the sixth on the right side with the exception that he had a vague sense of contact in both feet. This anæsthesia was complete to touch by cotton wool or to the prick of a pin, but he retained some deep sensation and could indicate whether the great toe was flexed or extended while on heavy pressure he knew which limb was being touched. Bedsores were present over the sacrum and on both heels.

The general aspect of the case was that of a complete destruction but the slight retention of sensory function encouraged me to hope that it might not be hopeless, and on exposure, I found the fourth dorsal spinous process with its laminæ broken off, although little, if at all displaced. This bony fragment having been removed the theca was laid bare from the second to the fifth arches and was found to be surrounded by a newly formed fibrous cicatrix which was dissected away. The theca was then opened and the cord presented no naked-eye abnormality. Recovery was slow but definite and thirteen months after the operation the patient writes me that he can now walk "with assistance."

The interest of this case lies in the fact that the retention of even a trace of function in the spinal cord below the level of the wound gives us ground for hope and that in such cases the injured structure should be placed as soon as possible in a position in which it will not be subjected to

cicatricial pressure. It is usually possible to determine at a very early date whether a paraplegia is due merely to concussion, and this point having been determined the sooner the cord is set free from all anatomical embarrassment the better.

Of injuries to *peripheral nerves* we had many but, as all arrived too late for primary suture and it was impracticable to retain them until ready for secondary suture, the great majority were sent to England and throughout most of the period referred to I operated only for the relief of pain. In several of these cases the removal of very recent cicatrices from around nerve trunks was readily effected and was followed by immediate relief of pain and by very rapid recovery of function in paralysed or anæsthetic but undivided nerves. Towards the end of the time owing to the difficulty with regard to hospital ships, patients remained with us much longer and nerve suture was performed more often. The results differed in no way from those obtained at home but I know of no cases retained long enough to expect recovery of function after suture of a large trunk.

Operations for *secondary hæmorrhage* were naturally common among the highly septic cases received from Gallipoli and it appeared to me that such cases were more prone to gangrene than in England and France, possibly on account of the great exhaustion of the patients before being wounded, of the severity of the sepsis or of the difficulty of obtaining and maintaining asepsis of the skin. On the other hand a number of aseptic operations for aneurysm and arterio-venous communication gave uniformly good results.

Abdominal injuries only came before us at a late stage and the number of convalescent cases seen on their way to England was small. In some half a dozen instances I operated to close intestinal fistulæ and these gave no trouble. Wounds of the *chest* also presented no points of special interest.

Compound fractures and wounds of large joints were met with in large numbers and presented no problems other than those with which the profession is now thoroughly familiar. These cases we also received at a late date and often in a condition of extreme and extensive sepsis. Under such circumstances I am satisfied that surgical interference should only be adopted when absolutely essential and should be of the most restricted type. Attempts at excision of joints or of extensive removal of bone gave most unsatisfactory results and would often relight or aggravate the acute condition. The best results were obtained by keeping a careful look out for points of tension with local relief of such points and without attempts to remove sequestra or foreign bodies unless they were readily accessible. Even in cases of some months standing, sequestrotomy was seldom satisfactory unless removal of the dead bone could be effected with precision and without unnecessary bruising or other disturbance of tissue, while careful drainage was necessary even in the case of very late operations. In the knee-joint especially I found that excisions three or four weeks after the

original wound did not save the limb, and when the free incision of pouches and pockets of pus was not followed by rapid improvement it was generally advisable to amputate without delay. These conclusions, arrived at from watching cases for a longer period than those treated in France, will probably be confirmed by the experience of late results as obtained in British base hospitals and, depressing as it is, amputation will I think prove to be the best method of treating many of the more serious injuries of the lower limbs which are at present being dealt with by more conservative attempts whose success is only too often very problematical.

It will be obvious from remarks already made that after the evacuation of Gallipoli a great deal of our surgical work was concerned not so much with war wounds as with the treatment of diseases incidental to this particular war zone or with that of ordinary surgical conditions under somewhat abnormal conditions, and to some of these conditions we may now refer.

After June of 1916 when cases of *malaria* began to arrive in large numbers from Salonika the co-existence of this disease had to be considered in connexion with all surgical injuries and it became the exception rather than the rule to operate upon men who had not recently been suffering from malarial infection.

In such cases if a febrile attack happened to be in progress we endeavoured at least to postpone operations until its close and in all others a previous preparation by a three or four days' course of quinine was if possible adopted. In spite of these precautions it was however quite common to find recurrences of malarial fever on the first or second day after even trivial operations, but apart from occasional difficulties of interpretation and diagnosis due to rises of temperature, I saw no case in which I could regard the complication as a serious one. Exact statistics I cannot give but there can be little doubt that in the second half of 1916 at least seventy-five per cent of all our admissions were malarious subjects, and in one hospital where a record was kept we found that three-quarters of the cases of minor operations upon patients known to be malarious showed rises of temperature not explicable by the surgical condition, although only twelve per cent had rigors. It was especially noticeable that these attacks of post-operative malaria were more liable to occur in cases in which the operation could not be fully aseptic and hence in such comparatively slight proceedings as removal of tonsils, opening abscesses, removal of hæmorrhoids and the like. On the other hand, I do not recall an instance of malarial fever following any serious aseptic operation although the obvious fallacy presents itself that such operations were not likely to be undertaken in malarious patients. As illustrating this connexion of malarial recurrence with slight sepsis we may refer to a case of aseptic amputation of a stiff finger in a man who had had frequent attacks of malaria; he had no rise of temperature after the operation, but, the sutures being removed on the seventh day, the temperature rose suddenly to 102° F.

on the eighth day, and it is at least possible that we may assign this result to some minor skin infection in connexion with the suture removal, such skin infections being as we have seen extremely common. Be this as it may the fact impressed itself strongly upon me that the appearance of malaria after operation was probably due to the presence of some infection however slight rather than to the mechanical lesion.

Along with malaria *dysentery* greatly influenced the whole of our work, both by providing lesions of surgical importance and by complicating the question of diagnosis. It has to be constantly borne in mind that dysentery, in the usual significance of the term, is but a symptom of amœbiasis and thus we were not seldom called upon to treat dysenteric abscesses of the liver in men who had no previous history of diarrhœa. On the other hand many cases of comparatively mild intestinal dysentery commenced rather suddenly with general "abdominal symptoms" and pain, which was often localized for at least some days in the right iliac fossa, thus rendering by no means easy a diagnosis between dysentery and appendicitis as illustrated by the two following cases seen on two consecutive days.

Pte. M. was admitted to Imtarfa Hospital on July 26, 1916, as a case of convalescent dysentery, and was on August 19 ordered ordinary diet. For four days he then had a slight evening rise of temperature to which no importance was attributed. On August 21 he complained of sudden and severe pain in the right iliac fossa, the temperature rose to 100° F. and pulse to 120; the bowels were constipated; he had no vomiting. When I first saw him on August 23 he was evidently very ill, the temperature and pulse-rate were as on the 21st, the whole abdomen was full and somewhat tumid with definite rigidity of the right rectus and great pain localized in the right iliac fossa, whence it extended down to the right thigh. Absence of vomiting was the only departure from the classical picture of appendicitis, and I at once operated as for that disease. No free fluid was found in the abdomen; the cæcum, appendix, and so much of the small intestine as presented in the incision were all congested and somewhat œdematous. The appendix, which was removed, did not differ in appearance from other parts of the bowel or present any condition capable of evoking the symptoms. Immediately after operation emetine treatment, which had been discontinued for some weeks, was resumed. Symptoms were by no means immediately relieved, the pyrexia and general abdominal distension remaining for some ten days, after which recovery was complete. At no time was there any diarrhœa.

Pte. W. developed dysentery at Salonika in June, 1916, and was admitted to Imtarfa Hospital on August 16. He was apparently making a normal convalescence when on August 21 he vomited once and was said to have had a little blood in the vomit. For the following two days he again appeared to be quite well, and on August 23 he was allowed to get out of bed for the first time since admission. On the evening of this day he was seized with sharp pain in the right iliac fossa and the temperature

rose to 99·6° F.; there was no recurrence of the vomiting. I saw him on the following day, when he complained of aching pain in the right iliac fossa, where he had considerable tenderness, resistance and cutaneous hyperæsthesia. The abdomen presented exactly the same general fullness and tumidity as did that of the previous patient. In this case operation was deferred until the following day, when the localized pain and rigidity had become much more marked and there was also pain on passing urine. On now opening the abdomen I found the cæcum much congested, œdematous and thick-walled, but in contrast with the last case the appendix was suppurating and differed in no way from the ordinary acutely inflamed structure, while it was surrounded by a small amount of peritoneal exudation. Unfortunately no more complete pathological examination was made, and the specimen was thrown away without any search for dysentery-producing organisms. In this case there was no post-operative emetine treatment, and symptoms passed off rapidly and without such delayed convalescence as met with in the last case.

These two examples, which could easily be multiplied, serve to illustrate the difficulty of diagnosis which is not lessened by the possibility of meeting with a truly amœbic appendicitis, although I was never able to satisfy myself of the occurrence of this condition in Malta, and regarded all the cases of appendicitis in dysenteric subjects as intercurrent or at most as predisposed to by the bowel lesion.

Apart from such occasional difficulties of diagnosis, amœbiasis provided us with a considerable amount of surgical work. Perforations of the intestine were met with, but of these two only came under my own observation; both were *in extremis*, one dying on the way to the operating theatre and the other very shortly after operation, but the general experience of these very serious cases was most unfavourable, and I can recall only one instance of recovery after early operation. In some of the earlier cases of severe dysenteric colitis the operation of appendicostomy was practised, but was, I believe, soon abandoned, and I did not personally meet with any cases in which I thought it likely to be of service. With the value of this proceeding in old-standing cases of colitis we are not now concerned; all our cases were recent and acute, and in those which could not be dealt with by medicinal methods, including, of course, the invaluable emetine, the condition was too desperate to allow of much hope from a somewhat serious operation, which in any case could only deal with the large intestine and was useless as a direct attack upon the small bowel or upon the intense toxæmia.

Having regard to the large amount of dysentery and the large number of cases of enlarged liver which passed through our hospitals, *abscess of the liver* requiring surgical operation was by no means common, and there can, I think, be no question that this comparative rarity was due to the early recognition of the disease and its prompt treatment by emetine. In many cases I saw enlargements of the liver, often to an extent which made almost

certain the presence of a large abscess, but in which complete return to the normal size was attained after a ten days' course of emetine, and the cases calling for operation were generally those which had been overlooked or those in which had occurred some complication such as a perforation. I would also attribute to the use of emetine immediately after operation the fact that the results of operation were very good even in complicated cases, such as rupture into the stomach or peritoneum. Of some two dozen personal cases all recovered except two, one of which had before operation general peritonitis from rupture, while the other had double empyema and also a very severe attack of malignant malaria. In all cases requiring operation I adopted the open method and used a drainage tube, nor do I think those which I saw could be dealt with in any other way. No doubt some of the large livers which yielded to medicinal treatment might, if explored with the needle, have been found to contain "abscesses" and might have given good results from aspiration, but as the results were sufficiently satisfactory without any surgical interference I see no reason to regret not having adopted this proceeding. I know of no instance in which post-mortem examination revealed an abscess overlooked during life, and can only conclude that in our cases either recovery could be obtained by drugs, or that, failing these, it was wise to follow the general principles of surgery. Putting the matter in another way, we may perhaps say that a purely amœboid infection will yield to emetine, whereas an infection associated with pyogenic bacteria demands drainage.

In connexion with the question of liver abscesses I may quote one more case as an example both of the occasional difficulties of diagnosis and of the results of combining operation with the use of emetine.

Pte. S., an R.A.M.C. orderly, was admitted to Valletta Hospital on the afternoon of April 6, 1916. He had been serving in Malta only and up to this date I had not heard of any cases of dysentery originating in the island, nor had he any history of diarrhœa. He said that for about a fortnight he had been "feeling feverish" and that he had had some bronchitis, but he did not report sick until 2 p.m. on the day of admission. At that hour he was attacked by acute abdominal pain more marked on the right side. At 3 p.m. he vomited a small quantity of yellow fluid, and at 5 p.m. he was seen by Lieutenant Gillies, who found acute pain of the right abdomen mainly in the upper half, with tenderness in the right hypochondrium, and to a less extent in the right iliac fossa. When I saw him an hour later he was evidently acutely ill and presented symptoms as already described, except that the pain was more marked in the right iliac fossa and tenderness appeared to me to be more severe there than elsewhere. The liver dullness was normal; there was some general bronchitis. The diagnosis appeared now to lie between that of appendicitis and a perforation of the duodenum. An incision over the appendix revealed only a large quantity of odourless fluid. A second incision through the upper part of the right rectus muscle gave exit to more free fluid and to some

odourless grey debris. The gall bladder and duodenum having been found to be normal I discovered on the under surface of the quadrate lobe of the liver and close to the longitudinal fissure a cavity large enough to admit the terminal segment of the thumb and giving exit to a pale grey pus, and it was clear that we had here a hepatic abscess which had ruptured into the peritoneum. After abdominal toilet a drainage tube was inserted into the abscess cavity and another into the adjacent peritoneum. The pus removed was found to contain amœbæ, and emetine was used from the morning after the operation, § grain being given by the mouth daily for nineteen days. Amœbæ were found in the pus from the drainage tube on the first, third, fifth and sixth days after operation, but at no later date; recovery was complete.

An interesting but somewhat obscure condition of which I saw several cases in the autumn of 1915, was *thyroiditis*, possibly of dysenteric origin. In these patients most if not all of whom were convalescent from dysentery, the thyroid gland became enlarged, painful, very hard and very tender on one or both sides, and it differed entirely from the soft swollen thyroids with which we became familiar in men presenting marked nervous symptoms. The swelling, which was not uniform but generally fairly limited, was wanting in the definition of an adenoma, while its somewhat vague outline and marked hardness recalled rather the appearance of an early case of malignant disease; there were no concomitant symptoms of hyperthyroidea. Those cases which I saw varied a good deal in size from time to time, but all tended to gradual recovery without any special treatment, and I much regret that during the period of their incidence it did not occur to me that they might be dysenteric in origin, and consequently I did not further investigate them. After the autumn of 1915 I saw no more of such cases, possibly because of the increasing use of emetine in the primary dysentery, but at Salonika I met with one in a man who had also had dysentery, and who developed an abscess in the thyroid isthmus; in this case an examination of the pus failed to reveal any organism which could be cultivated; amœbæ were, however, not looked for, and it was too late to do so when I saw the case.

I cannot conclude this hasty and imperfect account of over two years of surgical work in the Mediterranean without an equally imperfect expression of my sincere thanks to those men and women of all ranks whose loyal help and constant good humour under many trials have been the happiest feature of that work. From many of them I have learnt much and, on the other hand, I always found them ready to adopt new ideas or to carry out my own suggestions. I have purposely avoided mentioning any of their names, as to do so would have involved me in an invidious selection from among too many of my friends. But I am sure that they will feel, as I shall, in the years to come, that the recollection of having worked together in Malta is a link of friendship more binding than many an acquaintance of far older date.

SOME EXPERIMENTAL OBSERVATIONS ON PERFORATING WOUNDS OF THE ABDOMINAL VISCERA.

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Paragraph 1.

We have set ourselves to work out experimentally certain facts regarding penetrating wounds of the abdomen regarding which the clinical evidence is at present somewhat obscure.

The first question with which we shall deal is that of, "*To what extent can perforating wounds of the intestine recover without operation?*"

It is undoubtedly a fact that certain cases of perforating wounds of the intestine recover without operation—clinical evidence of this has been obtained during the present campaign. It is our purpose to test the experimental evidence and, if possible, to indicate the circumstances under which such a possibility may be expected to occur.

During the South African War of 1899-1902, owing to the difficulties of transport, and the lack of suitably equipped hospitals close to the firing line, comparatively few of these cases were operated upon. Surgeon-General Stevenson in the official history collected only 207 cases of "gunshot wounds of the abdomen," with twenty-six laparotomies, of which eighteen died. A certain proportion of the cases recovered without operation, and this fact, in the early stages of the present campaign, undoubtedly modified for a time the treatment of such cases. It may be assumed that the universal opinion now is that early operation offers the best chance of recovery. Makins states: "Perforating wounds of the small intestine are very fatal injuries. Every person in whom this condition was certainly diagnosed, died."

As we have said, the first part of our experimental work was done with a view to putting the possibility of spontaneous recovery upon some definite basis. We found that bullet wounds of the intestine can be very closely simulated by cutting the gut wall with small sharp scissors. Such wounds show the typical pouting of the mucous membrane in its rosette-like form, no matter what part of the alimentary canal is injured, and Colonel Wallace, A.M.S., has made the observation that these wounds exactly simulate bullet wounds of the intestine, both macroscopically and on examination with the microscope. Into each wound so produced a lead

shot was introduced. The following account applies to such *single small wounds* :—

When single small wounds were made in either small or large intestine, we invariably found that the animal recovered. Usually the animal ate little or nothing on the day following operation, but on the second day normal diet was resumed. With such wounds a small amount of extravasation occurs at the time of the wounding, and the degree of the extravasation depends apparently upon the amount of contents of the gut at the time.

Multiple small Wounds.—Our next observation showed that several wounds of the same size (small) could be made in the same loop of intestine, and recovery follow. As many as five perforations could be made in the same loop of intestine, one inch of healthy bowel existing between each, and the animal recover. As a rule, when more than five perforations were made in the single loop of bowel, the animal died of general peritonitis. For example, experiment 20.

Summary.

Bullet wounds of the intestinal tract can be closely simulated experimentally. Single artificially-made wounds of small size recover, irrespective of the portion of the intestinal tract in which they may occur. Multiple small experimental wounds occasionally undergo spontaneous recovery, but, if too numerous, are fatal.

Protocol of Experiments : Part I.

No. 1. *Animal : hare. Wound of Middle of Ileum.*—September 5, 1916 : Laparotomy in middle line. Single small perforation made in bowel about middle of ileum with fine scissors; the wound showed well the prolapsed mucous membrane. A No. 4 shot was introduced into the bowel through the wound in the gut. No escape of intestinal contents. Loop replaced into peritoneal cavity and abdomen closed. September 7, complete recovery.

No. 6. *Animal : hare. Wound of Upper Part of Ileum.*—September 5, 1916 : Laparotomy in middle line. Three small wounds made in bowel at this point. The perforations were made on the anti-mesenteric border, two inches of healthy bowel existing between each perforation. Into each perforation a No. 4 lead shot was introduced. All perforations had the typical rosette appearance of the prolapsed mucosa. A small amount of bile-stained contents escaped on replacing the wounded loop back into the peritoneal cavity. Abdomen closed. September 6 : Animal well, eating a little,. moves freely about. September 7 : Animal quite normal again.

No. 8. *Animal : hare. Wound of Lower Part of Ileum.*—Septem-

ber 7, 1916: Etherized; laparotomy middle line. Lowest loop of ileum identified and three perforations made along the anti-mesenteric border; shot introduced into bowel as in previous experiment. The bowel showed little escape of intestinal contents and was replaced in abdomen. September 8: Animal quiet, looks well, has eaten a little. September 9: Recovered completely.

No. 11. *Animal: hare. Colon Wound.*—September 15, 1916: Laparotomy in middle line. The colon was identified and two small perforations made in it about two inches apart. Lead shot were slipped into the bowel in the usual way. One perforation was made between the longitudinal bands through the circular fibres, while the other was made through the longitudinal band on the anti-mesenteric border. September 16, 1916: Animal well and eating a little. September 19: Animal completely recovered.

No. 12. *Animal: hare. Colon Wound.*—September 15, 1916: Laparotomy. Colon perforated in a similar way as in previous experiment and bowel replaced into abdomen. September 17: Animal did well, ate day following operation.

No. 18. *Animal: hare. Jejunum Wound.*—September 24, 1916: Laparotomy middle line. Loop of upper jejunum brought out of wound 1½ inches from upper fixed end. Three perforations were made in the bowel, one inch of healthy bowel existing between each wound. Lead shot introduced through the prolapsing mucosa into the lumen of the gut. Straightforward recovery.

No. 20. *Animal: hare. Multiple Wounds of Small Intestine.*—September 28, 1916: Laparotomy middle line. Multiple small perforations; four made in the lowest loop of ileum; a similar number made in the middle of the small intestine and also in the jejunum. The stomach was noticed to be half full at the time of operation. Abdomen closed. Animal died ten hours later from a general peritonitis. There had been a considerable amount of extravasation of intestinal contents and more marked from the upper series of perforations, for there was a considerable amount of bile-stained fluid in the upper part of the abdomen among the coils of small gut.

No. 22. *Animal: hare. Wounds of Ileum.*—September 29, 1916: Laparotomy middle line. Five small perforations made in the lower ileum. Shot introduced into bowel through the prolapsing mucous membrane. September 30: Animal well; made good recovery.

No. 24. *Animal: hare. Wound of Rectum.*—October 11, 1916: Laparotomy middle line. Perforation made in rectum, the usual small wound being made with scissors. Animal ate freely on the following day and made a perfect recovery.

No. 25. *Animal: hare. Wound of Cæcum.*—October 12, 1916:

Laparotomy. Wound of cæcum made, small size, just large enough to introduce a No. 4 shot into the bowel through the perforation. No extravasation occurred at the time. Uneventful recovery.

No. E 15. *Animal: hare.*—September 18, 1916: Laparotomy in middle line. Two small perforations made in lower ileum four inches from the fixed end. Typical eversion of mucosa seen; shot introduced into the bowel. September 20: Animal quite recovered.

Paragraph 2.

The second question which we attempted to answer was as follows:—

If perforation of the intestinal tract occurs, is there any one portion of the gut that has a greater tendency to spontaneous cure than another?

Clinical evidence on this point is somewhat meagre. We know, however, that certain stomach wounds, which from their anatomical position are impossible of suture, may close spontaneously, and we have had personal experience of intra-peritoneal rectal wounds, occurring at the extreme lower limit of the pouch of Douglas, where the wound spontaneously closed.

We have made experimental wounds of varying size in all the various subsections of the intestinal tract, and we have tried to arrive at definite conclusions as regards the possibility of spontaneous closure in the varying subsections. Belgian hares and cats were employed in the experimental part. The various portions of the intestinal tract will be dealt with independently.

Stomach Wounds.

When small wounds were made there was a spontaneous recovery; by small wounds we mean those which were just sufficiently large to admit No. 4 shot. When larger wounds were made the animal succumbed; but one must add that if the wound was purposely covered with omentum—a wound even so large as to admit the finger tip—the animal recovered.

Wounds of Duodenum and Upper Jejunum.—These were found to be inevitably fatal. Apparently the escape of bile and digestive fluids, which occurs in this situation, prevent natural adhesions by omentum or peritoneum.

Wounds of Lower Jejunum and Ileum.—These showed a strong tendency to spontaneous cure. Omental and peritoneal adhesions formed, and eventually there was complete closure of the opening with very little scarring.

Wounds of the Large Intestine.—These wounds were found to be inevitably fatal.

Summary.

Wounds of the ileum show a greater tendency to spontaneous recovery than any other part of the intestinal tract.

Protocol of Experiments (relating to Paragraph 2).

No. 9. *Animal: hare.*—September 7, 1916: Etherized; laparotomy in middle line. Longitudinal incision made in the lowest loop of the ileum four inches from the cæcum. Incision in bowel about ¼ inch in length. The intestine was fairly empty at the time of production of the wound. The animal was always quiet from the time it recovered from the anæsthetic, and it died fourteen hours later. Post-mortem showed acute general peritonitis, with very marked local extravasation.

No. 14. *Animal: hare.*—September 15, 1916: Laparotomy in middle line. Small intestine, high up in jejunum, exposed; bowel half divided across transversely. Small amount of bile-stained contents escaped at the time of production of wound. Animal died nine hours later from peritonitis; there was considerable amount of bile-stained contents in the upper abdomen.

No. 17. *Animal: hare.*—Etherized; laparotomy middle line. The jejunum was exposed as in previous case, and in addition to making a perforation in the bowel wall (half dividing the bowel transversely across) an omental graft was sutured over the perforation. The wound itself was left unclosed. The animal was very quiet after operation, and died seven hours later. Post-mortem showed abundant exudate, thick and bile-stained, generalized throughout the peritoneum. It closely resembled the fluid seen in cases of ruptured duodenal ulcer. The omental graft was not firmly adhering at any point to or around the perforation where it had been attached. Contents in peritoneal cavity.

No. 26. *Animal: hare.*—October 15, 1916: Etherized; laparotomy middle line. Stomach exposed. Wound made in the middle of the anterior surface of the stomach wall at the junction of the cardia and pyloric canal. The wound was made in the transverse axis of viscus and the perforation was large enough to admit a pea. A small amount of fluid contents leaked out at the time of operation. Stomach was full at the time of operation. Post-mortem showed no general food extravasation, but a local collection not much more in quantity than was noticed at operation. There was a very marked general peritonitis present.

No. 27. *Animal: cat.*—October 16, 1916: Laparotomy. Small gut (lower ileum) three parts divided across transversely. Loop returned into small part of peritoneal cavity from which it came. On the following day it looked well, but ate nothing and remained quiet. Animal died fifty-six hours after operation. Post-mortem showed an acute general

peritonitis. There was no food extravasation of any kind; all intestines collapsed.

No. 30. *Animal: hare.*—October 18, 1916: Etherized; laparotomy. Wound made in the duodenum. The incision in the bowel wall was big enough to admit the nose of a pair of Spencer Wells artery forceps. Some bile-stained fluid escaped at the time the incision was made. October 19: Animal not well; not eating, very quiet. Died thirty-two hours after operation. General peritonitis; much contents all over the abdominal cavity.

No. 32. *Animal: cat.*—October 20, 1916: Etherized; laparotomy middle line. Animal had a large meal of meat just previous to the operation. Wound made in the ileum (lower end). The wound in this case was a large transverse one dividing the bowel three parts across. Loop replaced in the right iliac fossa. Immediately the bowel was divided the loop at the point of incision became markedly stenosed, completely blocking the lumen of the gut. There was very little eversion of the mucous membrane. October 22: Animal well; quiet, not eating. October 23: Animal much better; has eaten bread and milk. October 25: Continues to improve; quite recovered.

No. 37. *Animal: cat.*—November 14, 1916: Etherized; laparotomy middle line. Jejunum divided three parts transversely across. The loop taken was a point four inches from the upper fixed end of the bowel. November 15: Animal looks well; not eating. November 16: Animal looks very bad indeed. November 17: Animal died fifty-six hours after operation. Post-mortem showed a general peritonitis with bile-stained fluid throughout the peritoneum.

No. 40. *Animal: cat.*—November 20, 1916: Laparotomy middle line. Wound made in the large bowel (in middle of colon). The wound was a transverse one half dividing the bowel across. Gut replaced into abdomen. There was no hæmorrhage and no escape of gut contents followed the production of the wound. Animal died twelve hours later. Post-mortem showed localized peritonitis with very dirty fluid in the neighbourhood of the wound loop. The surrounding coils of small intestine were deeply injected. There was scarcely any spread of fæcal matter from the bowel.

No. 41. *Animal: cat.*—November 20, 1916: Colon wound made as in previous case. The site of the large intestine was the upper part of the rectum. The wound was transversely made to the axis of the bowel; loop replaced in abdomen. November 21: Animal looks well, is quiet; not eating. Later in the day she showed signs of "general weakness" and died twenty-nine hours after operation. Post-mortem showed a large amount of dirty fluid in the lower abdomen. No local extravasation of fæcal matter.

No. 42. *Animal: hare. Wound of Ileum.* December 28, 1916: Laparotomy in middle line. Loop of lower ileum half divided tranversely across and gut returned into abdomen. December 29: Animal quiet; has eaten nothing. December 31: Complete recovery. January 17: Examination of wounded coil showed it to be free in the peritoneal cavity. The only sign of the lesion was a small raised nodule in the line of the intestinal wound, chiefly involving the peritoneum.

No. 43. *Animal: hare. Wound of Jejunum.*—December 28, 1916: Laparotomy performed in middle line. An upper loop of the jejunum was half divided across. No escape of intestinal contents occurred at the operation. The animal died twelve hours later. Post-mortem showed general peritonitis.

Table of Experiments.

Large wounds of the lower ileum ..	4	...	2 died, 2 recovered.
Large wounds of the duodenum and jejunum	5	..	5 died.
Large wounds of the stomach.. ..	1	..	1 died.
Large wounds of the colon	2	..	2 died.

Paragraph 3.—The Behaviour of Omentum to Perforating Wounds of the Intestine.

The behaviour of the omentum is of great clinical interest and its value in various abdominal conditions has long been recognized.

We have attempted to analyse the behaviour of the structure when there is a wound of the abdominal hollow viscera. Clinically we have repeatedly made the observation that, in perforating wounds of the intestine, the omentum does not, primarily at least, come in contact with the injured gut. On the other hand, if the wound has not actually perforated the viscus, but has merely damaged and bruised its wall, the omentum migrates to the injured part and puts itself in such a position that it tends to prevent any further spread of infection. The second of these clinical facts is well illustrated by the following history:—

Pte. A. B. was struck by a fragment of shell on the left side immediately behind the great trochanter. The missile passed deeply across the buttock and passed out on the same side close to the middle line. There was intense local sepsis, to which the patient succumbed five days after the receipt of the injury. During the post-mortem examination it was found, on opening the abdomen, that the omentum was firmly adherent in the pelvis, shutting off and localizing a bruised necrotic area of the upper rectal wall. The projectile had not opened the peritoneal cavity, but somehow by its passage it had bruised and devitalized the gut wall. Now had there been a perforation of the gut of any size, we

believe the omentum would not have migrated to the injured part, but, being a non-perforating injury, its localizing effect came into play.

There are several possible explanations of such actions of the omentum.

(1) It has been suggested that perforation of the gut has been followed by a temporary paralysis of the intestinal tract, and that this paralysis prevents the omentum from being moved to the injured site.

(2) The second suggestion is that when the gut is perforated the local infection is so great that it acts upon the omentum, so to speak, as a negative chemiotaxis, repelling the omentum. On the other hand, when the gut is merely bruised, a positive chemiotaxis is induced and the omentum is attracted to the injured spot.

A definite answer can only be given when there is a definite solution to the question as to how the omentum finds its way about the peritoneal cavity.

As we have said, we have observed clinically that in perforating wounds of the intestine the omentum is not at the site of the injury, but is lying as a double barrier across the upper part of the abdomen. In all probability this position is taken up in order to form a barrier between healthy and affected peritoneum, and so prevent a further spread of sepsis into the upper and more delicate part of the peritoneal cavity.

Experimentally, we have demonstrated the following facts: When bruise-wounds of the intestine are made without actual perforation, the omentum is found to come down to the lesion and to aid in its immediate repair. The same procedure occurs when areas of the gut are devascularized.

In perforating wounds of the gut the omentum behaves differently. If, when the wound is made, the omentum is laid over the injured gut, it remains in this position and therefore takes some share in the subsequent repair. If, however, the omentum is not brought to the site of injury, it made no spontaneous effort to make its way there, but remains as a transverse barrier in the upper abdomen.

When the omentum is brought to the site of injury, its greatest benefit will be derived if it is anchored in this position with a few sutures. There are portions of the intestinal tract in which an omental graft, such as has been described, is useless. In the case of unsutured large wounds of the duodendum and upper jejunum (and certain parts of the large intestine ?) central grafts, even when fixed in position, are of little use. Apparently the omentum has little control over the intestinal juices of the upper end of the small gut.

It is interesting to record that we found the omentum capable of replacing a portion of resected stomach wall. The animal made a good recovery (see experiment No. 31 and fig. 1).

Summary.

(1) Omentum will spontaneously hasten to repair a bruised non-perforating wound of the intestinal tract.

(2) Omentum will take no spontaneous action in dealing with a perforating wound of the intestinal tract.

(3) When omentum is specifically laid over a perforating wound of the gut and preferably fixed there with sutures, it plays an important part in limiting infection and in hastening repair.

(4) When the duodenum and upper jejunum are perforated, omental grafts are of little value. Their salutory action appears to be prevented by the intestinal juices of the high small intestine.

(5) In gunshot perforating wounds of the intestine the omentum is generally found arranged as a barrier along the line of the transverse colon, and so shutting off the lower from the upper abdomen.

Protocol of Experiments (relating to Paragraph 3).

No. 2. *Animal: hare.*—Etherized; laparotomy. Appendix pulled up and half divided transversely across. Replaced into peritoneal cavity and the abdomen closed. The omentum was not seen at the operation. Seven hours later laparotomy was performed. There was a generalized peritonitis with a thin purulent exudate. The omentum had not come down to the site of injury, but lay well up in the upper abdomen.

No. 3. *Animal: hare.*—Etherized; laparotomy. A loop of the upper jejunum was divided half across transversely. Omentum laid over the injured loop, without the application of sutures. Abdomen closed. Seven hours later the abdomen was re-opened and the wounded loop lay in the same position still covered by the omentum, but not firmly adherent to it.

No. 4. *Animal: hare.*—Etherized; laparotomy. A loop of upper ileum was half divided across and replaced into the abdomen. The omentum was laid over the wounded loop. The abdomen was closed and re-opened five hours later. The injured loop lay where it had been replaced in the peritoneal cavity. The omentum lay adherent to the wound in the same position as it had been placed five hours previously.

No. 6. *Animal: hare.*—Etherized; median laparotomy. Three small perforating wounds made in the upper ileum, two inches of bowel existing between each perforation. The typical eversion of mucous membrane was seen and a small amount of intestinal contents escaped. Omentum laid over the wounded loop. Recovery uneventful. Eleven days later the abdomen was re-opened. The wounded loop was adherent to other loops of small intestine, and to the three perforations small tags of omentum adhered showing fine leashes of vessels running on to the peritoneal coat of the bowel.

No. 7. *Animal : hare.*—Etherized ; median laparotomy. Loop of jejunum wounded by making a longitudinal cut in the bowel ½ inch in length. The omentum was laid over the wound and the abdomen closed. Nine hours later the abdomen was reopened. There was a marked general peritonitis with extravasation of small gut contents throughout the peritoneum. The omentum no longer lay in contact with the wounded coil of jejunum but near to it.

No. 8. *Animal : hare.*—Etherized; median laparotomy. Lowest loop in ileum wounded. Three perforations made in the same loop, each presenting prolapse of mucous membrane. The omentum in this case was not seen. Abdomen closed ; recovery uneventful. Laparotomy nine days later showed signs of an old general peritonitis, firm adhesions existing between the wounded loop of gut and the other coils of the small intestine. The omentum was not adherent to the perforations.

No. 9. *Animal : hare.*—Etherized ; laparotomy. A longitudinal incision was made in the lower ileum ½ inch in length. Very little escape of intestinal contents was noticed at the time of injury. The omentum was not in the neighbourhood and was not brought over the wounded gut. Belly closed. The animal died fourteen hours later. Post-mortem showed acute general peritonitis with local food extravasation. The omentum lay away from the wounded coil and had not come to the site of injury.

No. 17. *Animal : hare.*—Etherized ; laparotomy. The upper jejunum was wounded by dividing the bowel half transversely across. Omentum tacked on to the jejunum around the wound of the gut by four sutures. Bowel replaced in abdomen. The animal died seven hours after operation. Post-mortem showed a general extravasation of gut contents throughout the peritoneum. The omental graft had not adhered to the wounded jejunum in spite of the Lembert sutures attaching it over the wound.

No. 19. *Animal : dog.*—Etherized; median laparotomy. The lowest loop in the ileum was divided half across transversely. A graft of omentum was sutured by Lembert stitches over the wide gaping wound. Coil of gut replaced into abdomen. Recovery uneventful. Two weeks later the animal was in perfect health and had lost no apparent weight. Animal killed. Post-mortem showed the omentum graft to be firmly adherent around the wound in the ileum. There were no general adhesions in the peritoneal cavity. After hardening the specimen in formalin, an examination was made from the inner aspect of the bowel. It showed a well punched-out ulcer, the size of a sixpence, the base of which was formed by the omentum covered over by a thin layer of mucous membrane (see fig. 2).

No. 23. *Animal : dog.*—Etherized ; laparotomy. Loop of upper jejunum half divided transversely across. A graft of omentum was sutured by Lembert stitches over the wound in the gut which showed well the

prolapse of muçous membrane. The bowel appeared to be empty and there was no escape of intestinal contents at the time of the operation. Loop replaced in abdomen. The animal died thirty-six hours later. Post-mortem showed a general peritonitis with considerable extravasation of slightly bile-stained viscid fluid. The omental graft had become separated from the gut and a portion of it showed a patch of gangrene. The graft was not adherent to any part of the jejunum except at the points of the Lembert sutures.

No. 31. *Animal: dog.*—Etherized; laparotomy. Median laparotomy; portion of the anterior stomach wall was removed. The resected portion measured $\frac{3}{4}$ inch by $\frac{1}{2}$ inch. The wound in the stomach admitted the tips of three fingers and showed marked prolapse of mucous membrane. The omentum was sutured loosely by Lembert stitches to the peritoneum around the resected portion of the stomach. Abdomen closed. Recovery was straightforward. The animal lost no weight and was well a month later, when it was killed for examination. At the post-mortem examination the stomach, with over-lying attached omentum, was adherent to the anterior abdominal parietes in the line of the laparotomy incision. On separation of the omentum from the abdominal wall, it lay attached to the stomach wound, having much the same appearance as seen at the operation. The interior of the stomach showed a small round ulcer having the appearance of a healed "chronic gastric ulcer." The base was the size of a threepenny bit and was continuous with the normal surrounding mucosa (see fig. 1).

No. 32. *Animal: cat.*—Etherized; laparotomy. Lower ileum wounded. Gut was divided half transversely across and replaced in peritoneal cavity. The omentum was laid over the wound in the bowel without sutures. Recovery uninterrupted. Animal killed for examination four days later. Post-mortem showed no peritoneal adhesions; there was a tag of omentum adherent to the wound in the bowel. It was easily separated and the gut contents immediately escaped on undoing the omental adhesion.

No. 21. *Animal: hare.*—Etherized; laparotomy. Wound made in stomach $\frac{1}{2}$ inch in length in anterior wall of cardia. Graft of omentum sutured over the perforation by Lembert sutures through the adjacent peritoneal coat of stomach. The actual perforation in the stomach wall was not closed. The gaping mucosa could easily be seen shining through the thin omental covering. Animal made a straightforward recovery. Killed for examination three weeks later. Post-mortem showed dense adhesions of omentum around the perforating wound. From the inner aspect of the viscus a small healed ulcer was seen (see microphoto. No. 1).

Paragraph 4.—Mode of Repair in Intestinal Wounds which Undergo Spontaneous Recovery.

It appeared to us to be of interest to know the exact details of repair in perforating intestinal wounds which recover spontaneously. Belgian hares were employed in the various experiments. Perforating wounds were reproduced by cutting the bowel wall with fine scissors. Eversion and prolapse of the mucous membrane inevitably occurred. Subsequent observations were first made twenty-four hours later. There was found to be a gluing together of the intestinal coils in the neighbourhood of the lesion. It was remarkable that in every case the general peritoneal cavity was unsoiled.

If the injured bowel at the time of the experiment is covered with omentum, interesting results were observed. At the end of twenty-four hours the omentum remained extensively glued over the injured site. It remarkably limited the infection, and there was very little evidence of inflammation of the surrounding gut. The affected and the neighbouring coils of gut were somewhat distended and if the omentum was separated from the gut there was immediately a profuse escape of intestinal contents.

Three days after the original operation, the relationship of the omentum to the injured gut had altered. The gut was free except at the actual point of injury. At each of these, a tag of omentum firmly sealed off each perforation (see fig. 3.) Separation of the omental tag showed little change in the actual gut-wound. The mucous membrane was prolapsed and showed a slightly fibrosed appearance. Separation of the omental tag was at once followed by escape of intestinal contents.

Examination one week after the original operation showed the omentum adherent only at the points of perforation of the gut. The omentum was firmly adherent to the gut and a vascular anastomosis could be traced in the shape of leashes of fine vessels passing between the omentum and the bowel wall.

On separation of the omentum, the rosette of prolapsed mucous membrane was no longer visible, but the situation of the prolapse was occupied by a plug of yellow fibrin which blocked up each perforation. In certain colon wounds the fibrin plug was found to contain large Gram bacilli of the perfringens type (see fig. 4, microphoto. 2).

Wounds examined at a later date showed varying changes. It would appear that during the second and third weeks there is a tendency for sacculation of the mucous membrane to occur at the site of injury. This was especially evident in Experiment 13. The lower ileum had been wounded, and the lesion covered with omentum. Twenty-two days later the lesions were found closed by firm omental adhesions. At each point of injury there was a distinct hernia of the mucous membrane through the

gap in the muscular wall of the gut into the overlying omentum. This experimental fact is interesting, because it so closely bears out the following clinical findings:—

Pte. A. L. was shot through the abdomen by a rifle bullet in September, 1915. He was not operated on, and he was eventually evacuated to England, where he underwent a prolonged convalescence. He eventually returned to duty in France, and he was again shot in the abdomen in June, 1916. On this occasion he was admitted to hospital under the care of Capt. G. Bell, R.A.M.C., to whom we are indebted for the notes of the case.

At the operation very extensive and old-standing adhesions were found all over the abdomen, making complete examination of the small gut extremely difficult. At irregular intervals over several feet of small intestine signs of previous damage were found in the shape of numerous finger-like processes which seemed to consist of mucosa alone, and to be herniating through the gaps in the muscle coats. Between two adjacent cells there was at one point a miniature entero-enterostomy, the lumen of which admitted a stout probe.

Though there can be no doubt that such a case as this is extremely rare, yet it illustrates the possibility, and, to some extent, the method of spontaneous cure of small intestinal wounds. We would add that the rarity of such a case must be so great that its occurrence ought in no way to modify the present accepted rule of immediate operation.

We have always drawn attention to the power and the value of the omentum as a means of aiding spontaneous cure of intestinal wounds.

Experimentally we record a case of spontaneous cure of a stomach wound when the cure was entirely dependent upon the omental graft employed.

In the anterior wall of a rabbit's stomach, a wound ½ inch long was made. The wound was covered with an omental graft, lightly sutured in position. No sutures were inserted into the actual stomach wound. Three weeks later the omentum was found firmly adherent to the wound. The interior of the stomach showed a small round pit-like depression, not unlike a healed gastric ulcer. Microscopical examination showed that the gap in the stomach wall was closed by a thin layer of dense cicatricial fibrous tissue, formed partly from the peritoneal coat, but chiefly from the portion of the omentum which was grafted over the wound. The inner aspect of the layer had no epithelial lining, but was covered with a thin layer of necrotic tissue slightly invaded by leucocytes. The cut edges of the mucous membrane had been drawn outwards by cicatrization over the cut edge of the muscular coats, closely simulating the condition of a chronic gastric ulcer.

Summary.

(1) In the absence of omentum spontaneous closure of intestinal wounds occurs by adhesion of neighbouring coils of intestine with a plastic peritonitis.

(2) Spontaneous closure is hastened when omentum is brought into contact with the injured part.

(3) The omentum is at first widely adherent over the injured part. At the end of three days the points of adhesion are limited to the actual gut perforation. At the end of seven days a vascular anastomosis has occurred between omentum and gut wall.

(4) Mucous membrane at the point of injury remains prolapsed for about a week, in this way to some extent blocking up the aperture. It is eventually replaced by a plug of fibrin.

(5) At the site of perforation there tends eventually to be a small sacculation of the mucous coat through the unsupported gap in the muscular tissue.

(6) Large areas of stomach wall can be replaced by omental tissue, but restoration of the stomach epithelium does not appear to occur.

Protocol of Experiments (relating to Paragraph 4).

No. 18. Animal: hare.—Etherized; laparotomy. Uppermost loop of jejunum perforated at three separate sites; one inch interval between each perforation. The gut at the time of injury contained little intestinal contents, and only a trace of bile-stained fluid escaped from each wound. Examination three days later. The injured loop was free in abdominal cavity, with the exception of a tag of omentum, which adhered to each perforation. The omental adhesions were easily separable from the gut. The perforation then showed little change to the naked eye. The prolapsed mucous membrane looked slightly more fibrous, and bile-stained fluid escaped from the bowel. When the omental tags were separated from the wounds, each wound showed the typical small yellow fibrin plug.

No. 24. Animal: hare.—Etherized; middle line laparotomy. A small perforating wound made in rectum; small amount of prolapsed mucosa. The recovery was uneventful. On examination seven days later, the wound in the rectum showed a small vascular scar covered by peritoneum, a definite gap still remaining in the muscle coats of the bowel wall. There were no definite adhesions between the rectum and other part of the bowel.

No. E 15. Animal: hare.—Etherized; laparotomy. Two small perforations made in the lower ileum. Typical eversion of mucosa produced. On examination seven days later, a yellow plug of fibrin covered each perforation. The omentum in this case was not adherent to the site of

injury. The loop was perfectly free in the abdominal cavity. Regeneration of peritoneum over the fibrin plugs.

No. 25. *Animal: hare.*—Etherized; middle line laparotomy. Wound made in cæcum large enough to introduce a goose quill; no extravasation seen at the time of injury, and there was little pointing of the mucous membrane. The animal was examined eight days later. The cæcum showed a thin newly-formed layer of peritoneum over the wound. There appeared to be a considerable gap in the muscle fibres at the site of injury, but no hernial protrusion had yet formed.

No. 8. *Animal: hare.*—Etherized; median laparotomy. Three perforations made in the lower ileum producing eversion of mucous membrane in each case. The gut was collapsed and there was little intestinal escape at the time of injury. Recovery straightforward. Nine days later examination of the injured loop showed marked adhesions to other loops of small gut and to the anterior belly wall, especially at the points of perforation. On separation of the adhesions, the wounds showed gaps in the muscle coats, but no definite hernial protrusions. There appeared to be a definite new lining of peritoneum.

No. 13. *Animal: hare.*—Etherized; laparotomy. Three perforations made in lower ileum. Omentum laid over the wounded coil. Recovery uneventful. Animal killed twenty-eight days after operation. Wounded coil was recognized in abdomen by the adherent tags of omentum at site of perforation. The omentum had evidently made traction on the loop as it showed a distinct tendency to saccular formation at the points of perforation (see microphoto. 3).

No. 11. *Animal: hare.*—Etherized; middle line laparotomy. Two small perforations made in the colon producing eversion of mucous membrane. One perforation made through the circular fibres between the longitudinal bands. The other was made through a longitudinal band of muscle. The omentum was laid over the colon but not sutured to the bowel. Recovery straightforward. Examination twenty-four days later showed a mass of omentum adherent to the colon at the point of perforation, forming a tumour the size of a small hazel nut. On section, the mass contained caseous material showing an old communication with the bowel through one of the perforation wounds. From the inner aspect of the bowel a small pit-like depression existed, leading into the caseous mass. A film examination of the caseous material shows large Gram bacilli of the perfringens type. The other perforation showed a similar caseous mass with adherent omentum much smaller in size.

No. 12. *Animal: hare.*—Etherized; middle line laparotomy. The colon was wounded in two places. An examination of the bowel one month later showed small yellow caseous bodies the size of No. 4 shot, one over each perforating wound; the peritoneum showed definite regeneration,

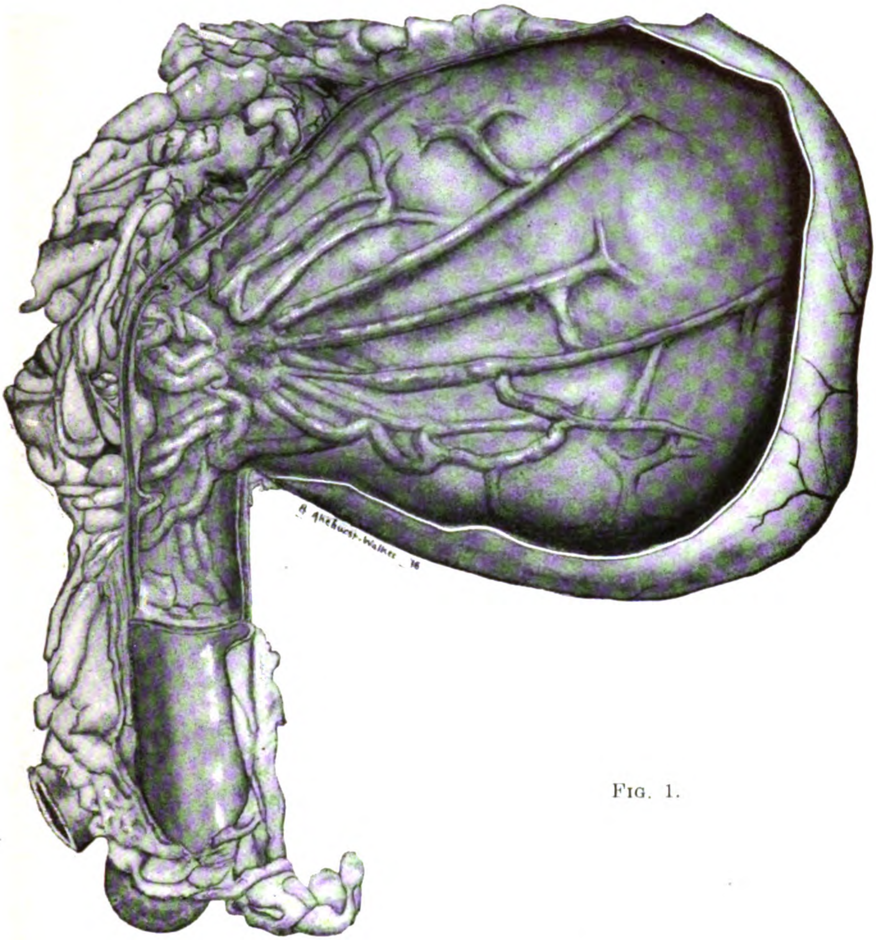

FIG. 1.

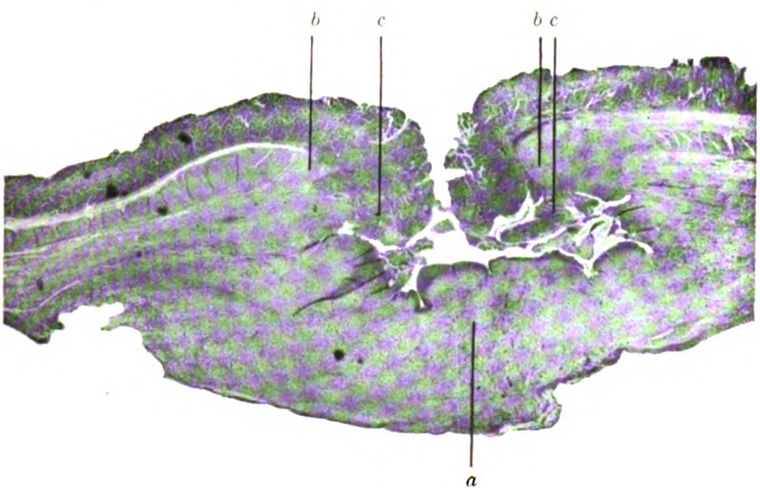

FIG. 2.

To illustrate "Some Experimental Observations on Perforating Wounds of the Abdominal Viscera," by Captain HAMILTON DRUMMOND and Captain JOHN FRASER.

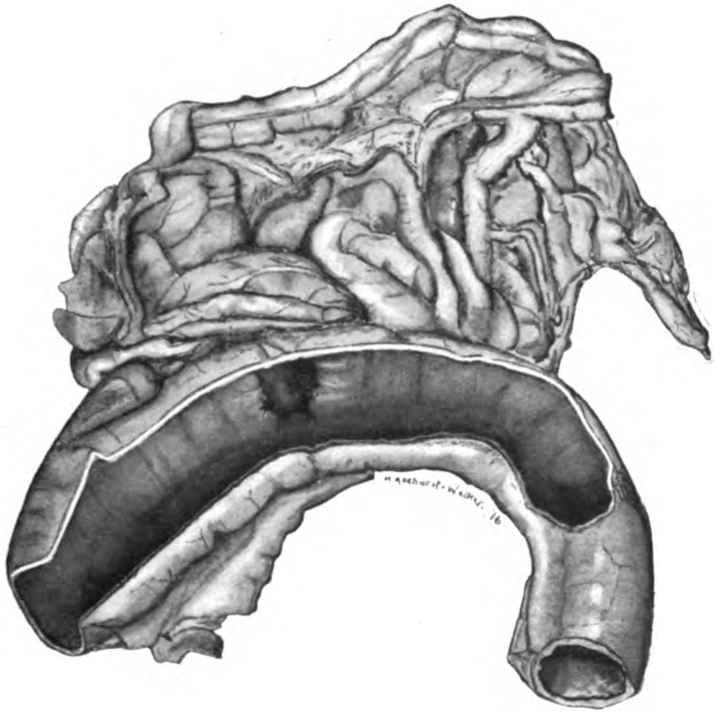

FIG. 3.

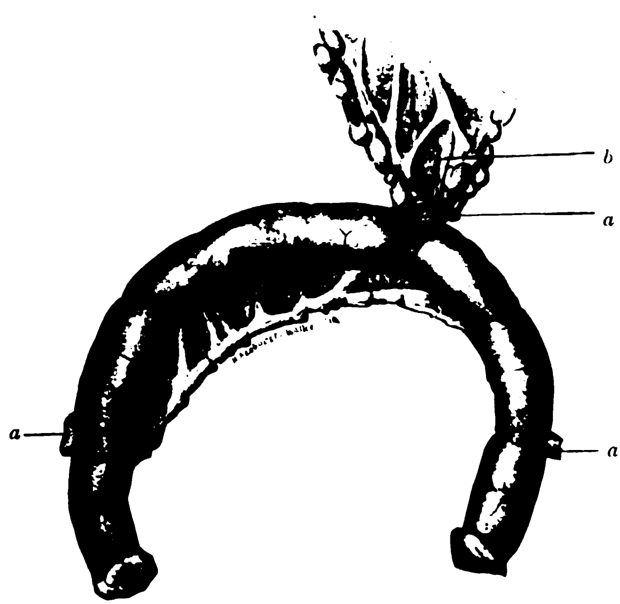

FIG. 4.

To illustrate "Some Experimental Observations on Peforating Wounds of the Abdominal Viscera," by Captain HAMILTON DRUMMOND and Captain JOHN FRASER.

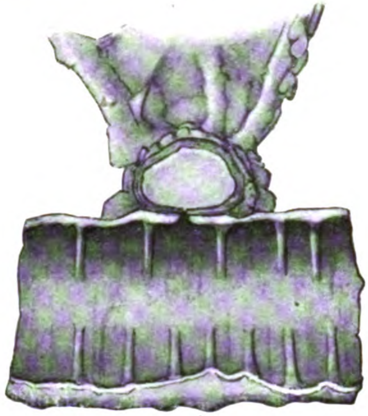

FIG. 5.

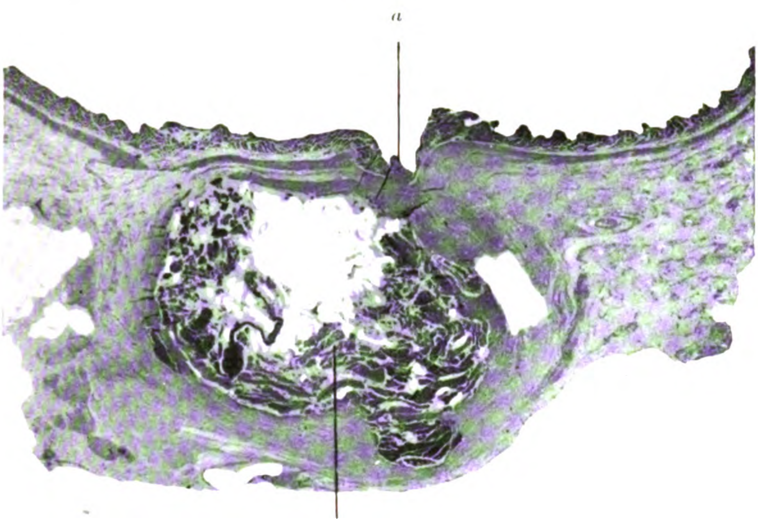

FIG. 6.

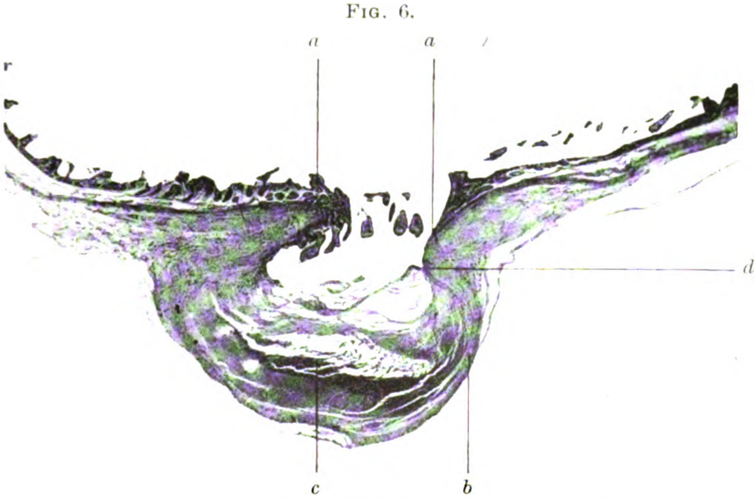

FIG. 7.

To illustrate "Some Experimental Observations on Perforating Wounds of the Abdominal Viscera," by Captain HAMILTON DRUMMOND and Capitain JOHN FRASER.

but not the muscle coats. No adhesions existed between the colon and other loops of gut.

We wish to acknowledge our indebtedness to Colonel Wallace, A.M.S., for his encouragement and esteemed advice, to Lieutenant-Colonel Winder, R.A.M.C., and Lieutenant-Colonel Frankau, R.A.M.C.(T.), for permission to investigate the subject, and to Captains Macnee and Dunn of No. 3 Mobile Laboratory, for the courtesy they have shown us, and the repeated assistance they have given us in carrying out these experiments.

DESCRIPTION OF PLATES.

FIG. 1.—(*Drawing.*)—Specimen shows the interior aspect of the stomach of a dog. A portion of stomach wall was excised, measuring ¾ inch × ½ inch. The gaping wound was left unsutured and a graft of omentum sutured to the adjacent healthy stomach wall by Lembert sutures: normal recovery. Examination a month later showed the wound to be completely healed by the omentum. The wound from the inner aspect showed considerable cicatrization and a healed ulcer the size of a threepenny piece, the base of which was formed by the omentum, covered by a layer of stomach mucosa.

FIG. 2.—(*Microphotograph.*)—Omental graft overlying unsutured stomach wound. (See Experiment 21, Hare.) The gap in the gastric wall has been closed by a thick layer of dense cicatricial fibrous tissue *a*, formed partly from the peritoneal coat and partly from the portion of omentum which was grafted over the wound. The inner aspect of this layer has no epithelial investment, but is necrotic and invaded by leucocytes. This exposed surface is of considerable extent, coinciding in size with the gap between the cut ends of the muscular tunic (*b*, *b*). The cut edges of mucous membrane (*c*, *c*) have been drawn outwards by cicatrization over the cut edges of the muscles, so as to simulate the condition in a chronic gastric ulcer.

FIG. 3.—(*Drawing.*)—Specimen shows the inner aspect of the lower end of the ileum of a dog. The bowel was half divided transversely across, producing a typical bullet wound; an omental graft was sutured over the wound without closure of the actual wound in the gut. Straightforward recovery followed. Examination two weeks later showed the omentum firmly adherent over the wound in the gut. The interior aspect of the bowel showed a well-marked punched-out ulcer, size of a sixpence, the base of which was covered by a thin layer of mucous membrane. See Experiment 19.

FIG. 4.—(*Drawing.*)—Specimen shows a loop of small intestine of a hare with three small perforations which underwent spontaneous cure. Each perforation shows a typical rosette of prolapsed mucous membrane (*a*, *a*, *a*). In this case (three days old) the loop lay free in the peritoneal cavity with a tag of omentum (*b*), adherent to each perforation.

FIG. 5.—(*Drawing.*)—Specimen shows perforating wound of the colon of a hare which underwent spontaneous recovery. Twenty-four days later a sac overlay the perforation with a wall of newly-formed fibrous tissue. The omentum adhered firmly to the walls of the sac surrounding the perforation.

FIG. 6.—(*Microphotograph*).—Perforating wound of colon which underwent spontaneous cure (Experiment 11, Hare.) The mucous membrane immediately round the narrowed aperture (*a*) is fibrosed and free from glands, and its epithelial covering is thin. There is a large sac with a wall of newly-formed fibrous tissue outside the bowel at this point (*b*). It is lined by granulation tissue, and contains necrotic debris, with organisms and leucocytes. The inflammatory changes are of quiescent type.

FIG. 7.—(*Microphotograph.*)—Perforating wound of the ileum, twenty-three days old, which underwent spontaneous cure. (Experiment 13, Hare). On microscopic examination, a wide gap is seen to persist between the original cut ends of muscular and mucous layers (*a*, *a*), and the repair which has been effected is due to the development of a thin layer of fibrous tissue from the peritoneal coat (*b*). This layer evidently bulges outwards, so as to form a saccule, and the hollow of the saccule is partially filled by a thick mass of fibrinous and necrotic material, infiltrated by leucocytes (*c*). The mass of dead material, which probably sealed the wound at a very early stage, is undergoing organization by ingrowth of vessels. It is also becoming covered in by a layer of columnar epithelium (*d*), extending out from the surface of the mucosa.

THE LATE APPEARANCE OF AGGLUTININS IN PARATYPHOID A FEVER.

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(*A Report to the Medical Research Committee.*)

In some recent reports on work in connexion with the behaviour of agglutinins in the paratyphoid fevers, especially in subjects inoculated either with anti-typhoid or the triple vaccine, certain observations have been made which were considered to point to the somewhat erratic course of these agglutinins, and which have accordingly been classed as anomalies. During the course of over 1,200 routine serological investigations in obscure pyrexias, cases of jaundice, and convalescent fevers of the enteric group in patients from Mesopotamia, certain of those anomalies have presented themselves. An opportunity has been afforded of attempting their elucidation through the occurrence of a number of acute cases, mostly all paratyphoid A fevers, which have been kept in this hospital over a prolonged period for "clearing" purposes. It has thus been possible to study the variation in the agglutination curve by blood examinations repeated at frequent intervals till the twelfth or fourteenth week of convalescence, and in some instances to the eighteenth and twentieth weeks, and certain phenomena have been observed which seem to go far to explain some of these anomalous findings. The investigations on several of the questions are still incomplete, but sufficient evidence has accumulated to justify the publication of the findings in regard to the extremely late appearance of the agglutinins in many cases of paratyphoid A fever. So delayed has been the response of these agglutinins in many instances that doubts are raised as to whether one can with any confidence attempt to draw a conclusion as to the special type of an "enterica" infection at any period during a pyrexia of three weeks' duration, or even before the thirtieth day from the onset of the fever. The importance of this conclusion has been repeatedly borne in upon us on comparing the deductions drawn from our own agglutination tests with those carried out in Mesopotamia at an earlier and more acute stage of the fever. For example, in quite a number of convalescent "enterica" infections which were admitted as "typhoid fever" on the diagnostic basis of an agglutination test which had been positive to *Bacillus typhosus* and completely negative to para A and para B we found on doing a series of Widal reactions after the twenty-eighth day from the commencement of the fever and onwards into late convalescence that para A agglutinins were distinctly present.

Dreyer [1] has pointed out that in the initial stages of paratyphoid A

fever the agglutination titre is very low, and that it may easily lead to a negative diagnosis unless the test is carried out with low dilutions of 1 in 20 or less of the serum. Walker Hall [2] cites two cases in which para A bacilli were isolated from the blood but no para A agglutinins were identified, even when the low dilutions recommended by Dreyer were used. It is however noted that the inoculation agglutinins showed variations in each case. No figures however are given for those cases, so that we are unable to determine whether the agglutination tests were carried on into convalescence. In 1911 Grattan and Wood [3] described how in paratyphoid fever the agglutinins of para A bacillus were preceded by a rise in *B. typhosus* agglutinins in persons who had been inoculated with *B. typhosus* vaccine. They concluded that an inoculated man suffering from paratyphoid fever, the original agglutination titre of his serum to *B. typhosus* due to his inoculation rises about the eighth day and reaches its maximum about the eighteenth. Thereafter it declines during the next three months, while the agglutinins for paratyphosus A do not appear much before the twelfth day, reach their height about the twenty-fourth day, and totally disappear within two months. Attention to this preliminary rise in *B. typhosus* agglutinins has recently been redirected by Martin and Upjohn [4]. These workers have also observed the appearance of para A agglutinins in the third, fourth, and fifth weeks, and have noted the fact that unless their investigations had been persisted in, numerous paratyphoid cases would have been diagnosed as typhoid fever. These observations have been confirmed during the course of the present work, and have been considerably extended in that agglutination tests have been performed as late as the twentieth week from the commencement of the fever, whilst the agglutinins have in all cases been worked out to their end-points. Several cases are also recorded below in which there was a typical enteric temperature, symptoms—rose spots, etc., associated with a mild toxæmia, and in which the agglutination tests as late the fifteenth day were persistently negative even in low dilutions of the serum. On continuing the agglutination tests into convalescence in spite of the completely negative results during the first two weeks, para A agglutinins appeared by the twenty-first day and were still present at the eleventh week. The possible influence of inoculation with the antityphoid and T.A.B. vaccines in leading to this delayed agglutinin response has also been investigated.

Technique Adopted.

The agglutination method used has been Dreyer's macroscopic method, slightly modified, the dilutions used being 25, 50, 100, 200. The agglutination of every serum has been worked out to its end-point, each series of dilutions being ten times greater than the one preceding, e.g., the second series being 250, 500, 1,000, 2,000, and so on. In a number of cases lower dilutions of para A were put up, as had been suggested by Dreyer. Sterile

TABLE 1.—AGGLUTINATION TITRES OF CASES INOCULATED WITH T.A.B.

No. of case	Name	Weeks since inoculation	Nature of inoculation	Duration of pyrexia	Organism isolated	•	Week of Disease. (Titre expressed in agglutinin units)																			
							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Frinn	26 13	T.V. T.A.B.	4 weeks	Para A (blood and fæces)	T.	0	125	..	357	400	400	40	..	225	20	20	..	..	20	40	40	..	..	..	..
						A.	0	15	..	715	715	2860	1387	..	30	15	15	..	..	15	7	7	..	..	..	..
						B.	0	0	..	0	0	0	0	..	0	0	0	..	..	0	33	33	..	..	..	..
2	H. Price ..	10	T.A.B.	2 weeks	Para A (blood and fæces)	T.	82	1000	..	25	..	..	..	40	..	400	..	..	40	..	40	..	..	..	..	..
						A.	7	70	..	280	..	..	..	70	..	280	..	..	14	..	35	..	..	..	..	..
						B.	40	40	..	0	..	..	..	0	..	20	..	..	30	..	30	..	..	..	..	..
3	Snape ..	30	T.A.B.	1 week, followed by relapse on 24th day	..	T.	0	0	10	..	..	100	100	..	100	..	10	..	40	..	22	..	..	..	..	..
						A.	0	100	22	..	..	1150	1420	..	500	..	140	..	14	..	70	..	..	..	..	..
						B.	0	0	10	..	..	100	3125	..	62	..	62	..	30	..	30	..	..	..	..	..
4	Harris ..	16	T.A.B.	25 days	..	T.	..	0	..	0	..	250	100	..	..	..	60	..	..	60	..	120	..	..	..	..
						A.	..	0	..	0	..	14	140	..	..	..	7	..	..	0	..	0	..	..	..	..
						B.	..	0	..	0	..	0	0	..	..	..	0	..	..	0	..	0	..	..	..	..
5	Shipway ..	25	T.A.B.	12 days, followed by relapse 19th-26th days	..	T.	0	..	..	20	..	200	100	..	6	225	40	..	40	40	..	..	..	..	..	..
						A.	0	..	..	285	..	28	0	..	10	250	70	..	70	70	..	..	..	..	..	..
						B.	0	..	..	0	..	0	0	..	0	0	0	..	14	7	..	..	..	..	..	..
6	Orford ..	80 30	T.V. T.A.B.	3 weeks	Para A (fæces)	T.	..	150	500	50	1000	..	100	..	50	100	..	..	..	..	..	..	..	..	..	..
						A.	..	0	3	285	50	..	14	..	0	14	..	..	..	..	..	..	..	..	..	..
						B.	..	20	20	40	20	..	20	..	20	30	..	..	..	..	..	..	..	..	..	..
7	Pearce ..	30	T.A.B.	3 weeks	..	T.	..	..	40	..	..	400	..	200	..	130	100	..	50	..	150	..	150	..	..	..
						A.	..	..	20	..	..	55	..	284	..	715	142	..	142	..	284	..	28	..	..	..
						B.	..	..	40	..	..	0	..	40	..	60	80	..	120	..	60	..	300	..	..	..
8	Blake ..	29	T.A.B.	3 weeks	Para A (fæces)	T.	..	..	80	..	800	..	100	..	50	..	100	100	142	..	28	..	..	..	..	..
						A.	..	..	250	..	355	..	510	..	510	..	145	250	580	..	58	..	..	..	..	..
						B.	..	..	20	..	20	..	0	..	0	..	0	0	0	..	0	..	..	..	..	..
9	Purcell ..	28	T.A.B.	Indefinite ambulatory case	..	T.	..	...	100	500	..	100	..	..	..	20	40	..	40	..	..	..	..	..	..	..
						A.	..	..	70	350	..	280	..	..	..	10	10	..	10	..	..	..	..	..	..	..
						B.	..	..	40	40	..	100	..	..	..	0	20	..	40	..	..	..	..	..	..	..

10	Weedan ..	65 20	T.V. T.A.B.	1 week	..	T.	..	50	..	50	0	..	..	180	..	..	..	225	..	..	..	125	30	..	..	22
						A.	..	0	..	150	700	..	..	35	..	..	..	150	..	●.	..	.150	30	..	..	0
						B.	..	0	..	0	0	..	..	0	..	..	..	20	..	..	..	60	30	..	..	15
11	Bebb ..	20	T.A.B.	2 weeks	..	T.	..	..	..	..	..	360	..	450	..	..	..	45	..	..	..	..	90	45	..	..
						A.	..	..	..	..	..	10	..	720	..	..	..	420	..	..	..	..	25	16	..	..
						B.	..	..	..	..	..	0	..	0	..	..	..	0	..	..	..	..	15	15	..	..
12	Herd ..	28	T.A.B.	18 days	Para A (fæces)	T.	..	12	100	..	100	..	12	..	44	..	12	..	50	..	..	..	..	..	..	..
						A.	..	3	28	..	28	..	14	..	28	..	14	..	8	..	..	..	..	..	..	..
						B.	..	4	15	..	15	..	15	..	30	..	30	..	30	..	..	..	..	..	..	..
13	Evans ..	20	T.A.B.	3 weeks	Para A (blood and fæces)	T.	..	50	..	50	..	100	..	25	..	150	..	15	..	70	..	30	..	100	..	..
						A.	..	70	..	70	..	700	..	280	..	280	..	560	..	560	..	280	..	180	..	..
						B.	..	60	..	15	..	15	..	60	..	30	..	60	..	60	..	90	..	120	..	..
14	Bond ..	132 12	T.V. T.A.B.	19 days	..	T.	..	44	55	55	..	..	44	..	55	..	55	55	..	..	..	..	..	..	..	..
						A.	..	85	94	370	..	...	188	..	45	..	37	33	..	..	..	..	..	..	..	..
						B.	..	8	8	0	..	..	16	..	8	..	16	8	..	..	..	..	..	..	..	..
15	F. Smith..	22	T.A.B.	14 days	Para B (fæces)	T.	..	..	..	..	..	45	..	90	..	45	..	60	..	45	..	..	..	..	..	..
						A.	..	..	..	..	..	148	..	37	..	148	..	74	..	57	..	..	..	..	..	..
						B.	..	..	..	..	..	571	..	714	..	800	..	320	..	160	..	..	..	..	..	..
16	Lloyd ..	13	T.A.B.	4 weeks	..	T.	..	20	..	..	..	...	..	..	80	..	..	..	..	..	..	..	..	..	..	..
						A.	..	60	..	..	..	..	..	..	420	..	..	..	..	..	..	..	..	..	..	..
						B.	..	10	..	..	..	..	..	..	0	..	..	..	..	..	..	..	..	..	..	..
17	Coen ..	40	T.A.B.	6 weeks	Para A (fæces)	T.	110	..	220	..	110	..	110	..	28	..	56	..	56	..	56	..	..	..	..	..
						A.	0	..	0	..	285	..	285	..	430	..	500	..	180	..	37	..	..	..	..	..
						B.	0	..	0	..	0	..	0	..	0	..	0	..	0	..	0	..	..	..	..	..
18	Kilshaw ..	16	T.A.B.	20 days	..	T.	..	0	..	11	..	44	..	44	..	..	44	..	..	..	..	..	..	..	..	..
						A.	..	0	..	28	..	284	..	142	..	..	10	..	..	..	..	..	..	..	..	..
						B.	..	0	..	0	..	0	..	15	..	..	8	..	..	..	..	..	..	..	..	..
19	Jones ..	72 32	T.V. T.A.B.	17 days	..	T.	..	222	..	22	..	55	..	55	..	55	..	..	..	..	..	..	..	..	..	..
						A.	..	14	..	57	..	288	..	188	..	13	..	..	..	..	..	..	..	..	..	..
						B.	..	0	..	30	..	0	..	8	..	8	..	..	..	..	..	..	..	..	..	..

distilled water has been used instead of normal saline solution for the diluting of the emulsions to standard opacity. It has also been used as the diluent to make up to a constant the amount of fluid in the tubes containing the varying dilutions used in the performance of this test. This use of distilled water was found to quite materially reduce the "zones of inhibition" met with in the course of routine agglutination tests, a fact which was afterwards found to have been noted by Sladden [5]. The tubes were incubated for two hours at 50° to 55° C., and the readings were then made after the tubes had been allowed to stand a quarter of an hour. The majority of the readings, including any uncertain tests, were confirmed by a second observer, and were re-read after the tubes had stood over night. The emulsions have been made according to the method recommended by Dreyer, Walker and Gibson [6], from strains of bacilli originally isolated from patients invalided from Mesopotamia, and obtained through the kindness of Major Glen Liston, I.M.S., Parel Bacteriological Laboratory, Bombay. All the records are strictly comparable as the agglutinability of these emulsions has been controlled by comparing them with the emulsions issued by the Medical Research Committee, against the high-titre sera of the Lister Institute. The emulsion of *B. typhosus* and *B. paratyphosus* B has maintained the same agglutinability as that issued by the Medical Research Committee, while the para A emulsion has been one-third stronger than that sent from England. All the readings have been recorded in agglutinin units per cubic centimetre of serum, according to the method recommended by Dreyer. Blood was in all cases obtained from a vein in order to ensure of there being a sufficient amount of serum for repeated examinations and for tests in higher dilutions if required. The examinations were repeated as often as routine work would allow, and as often as samples of blood could be obtained. In a number of the cases it was possible to obtain blood during convalescence only after the lapse of a number of weeks, when the patients were once again in touch with the laboratory for "clearing" purposes. In the fourteen cases in which *B. paratyphosus* A, or *paratyphosus* B was isolated either from the blood or fæces the organism satisfied the recognized fermentation and serological tests. Unfortunately it was found impossible to carry out satisfactory absorption tests owing to the lack of adequate centrifuging facilities.

Analysis of the Results.

In Table I are grouped together nineteen cases which had been inoculated with T.A.B. vaccine at varying intervals before their attack of fever. Five of these patients had also been previously inoculated with typhoid vaccine (T.V.). The interval which had elapsed since inoculation is recorded in weeks, as is also the duration of pyrexia. All the figures refer to standard agglutinin units for each of the three organisms, *B. typhosus* (T), *B. paratyphosus* A (A), and *B. paratyphosus* B (B). In ten of the nineteen cases the pathogenic organism was recovered from the blood or the fæces. Para A was isolated from nine of those patients, while No. 15

is a case of pure para B infection in which *B. paratyphosus* B was isolated from the fæces. Of the others, from the series of agglutination tests all are considered to be para A infections except No. 3, which appears to be a mixed infection of para A and para B. It may here be noted that a number of para B infections have been detected in the routine examination of the numerous convalescent enterics, jaundices, P.U.O.s, etc., admitted from Mesopotamia, as well as in some "enterica" infections, occurring among the Turkish prisoners under treatment here.

Table II gives a record of the same details regarding thirteen cases which had been inoculated with T.V. only, and one case, No. 14, which had never been inoculated. From four of these, *B. paratyphosus* A was isolated, all the others from the agglutination results being also regarded as para A infections.

To discuss the salient features of the most interesting cases of Table I seriatim: In Case 1, graphically shown in Chart A, para A was isolated from the blood on the fourth day of fever, while no trace of the presence of agglutinins to any of the three organisms was detected although the patient had been inoculated with T.A.B. vaccine only thirteen weeks before. On the fourteenth day *B. typhosus* agglutinins were distinctly present, viz., 125 units as compared with para A fifteen units. By the fourth week paratyphosus A agglutinins were produced in large amount, viz., 715 units, and reached their maximum—2,860 units—during the sixth week, after which there was a rapid fall. Thereafter the agglutinins for *B. typhosus* and para A, remained steadily at a low level from the ninth to the sixteenth week. It is to be noted that the agglutinins for para B were altogether absent until during the fifteenth and sixteenth weeks when they were detected in relatively small amount as compared with the average agglutinins due to inoculation. In this case be it noted that the organism was isolated from the fæces during convalescence as well as from the blood during pyrexia.

Case 2 (see Chart B) is interesting in that there is well shown the preliminary rise in *B. typhosus* agglutinins about the fourteenth day with a production of agglutinins amounting to 1,000 units and almost four times as high as the maximum recorded value for para A agglutinins. Here also *B. paratyphosus* A was isolated from the blood on the fourth day of pyrexia as well as from the fæces during early convalescence. About the tenth week there is a second increase of para A agglutinins to 280 units with a synchronous rise for *B. typhosus* to 400 units. No recognizable change in the clinical condition of the patient could be associated with this marked rise in agglutination titre.

Case 3 appears to be a dual infection of para A and para B; the maximum production of agglutinins occurring for both about the sixth to the eighth week. A relapse with fever occurred on the twenty-fourth day. Unfortunately in this case we were unsuccessful in isolating any organism.

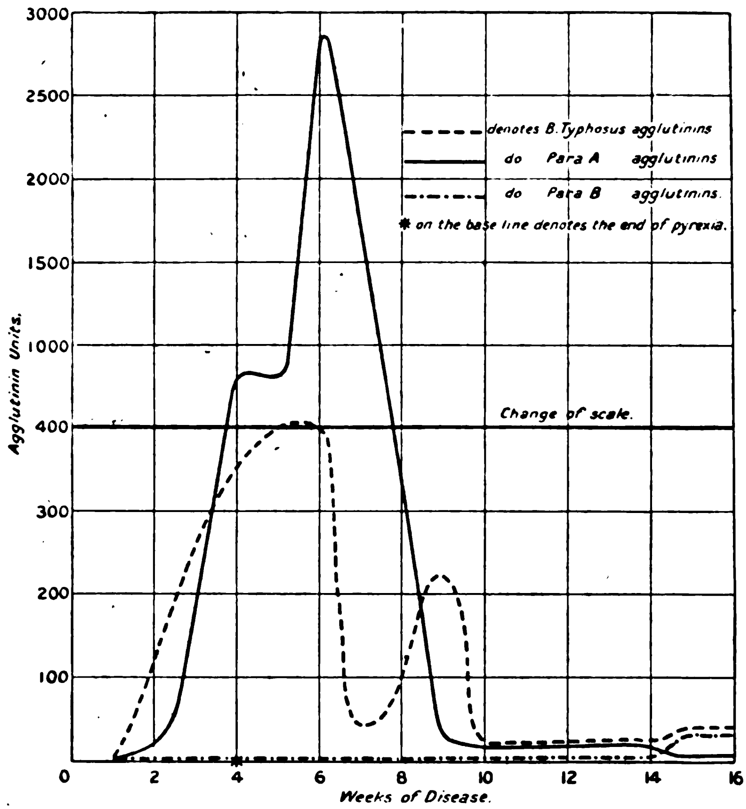

CHART A.—Prinn (see Table I, No. 1). Inoculated T.V. and T.A.B. Para. A isolated from blood and fæces.

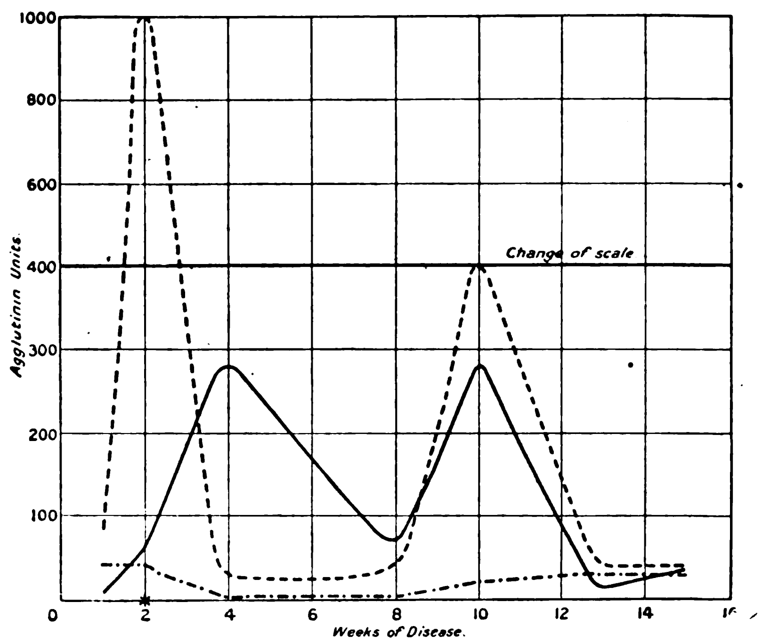

CHART B.—H. Price (see Table I, No. 2). Inoculated T.A.B. Para. A isolated from blood and fæces.

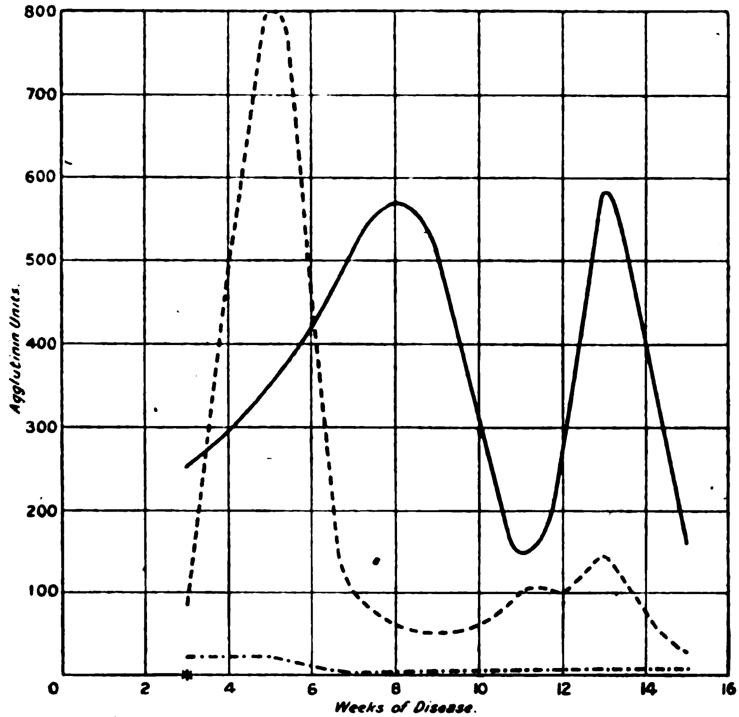

Chart C.—Blake (see Table I, No. 8). Inoculated T.A.B. Para. A isolated from fæces.

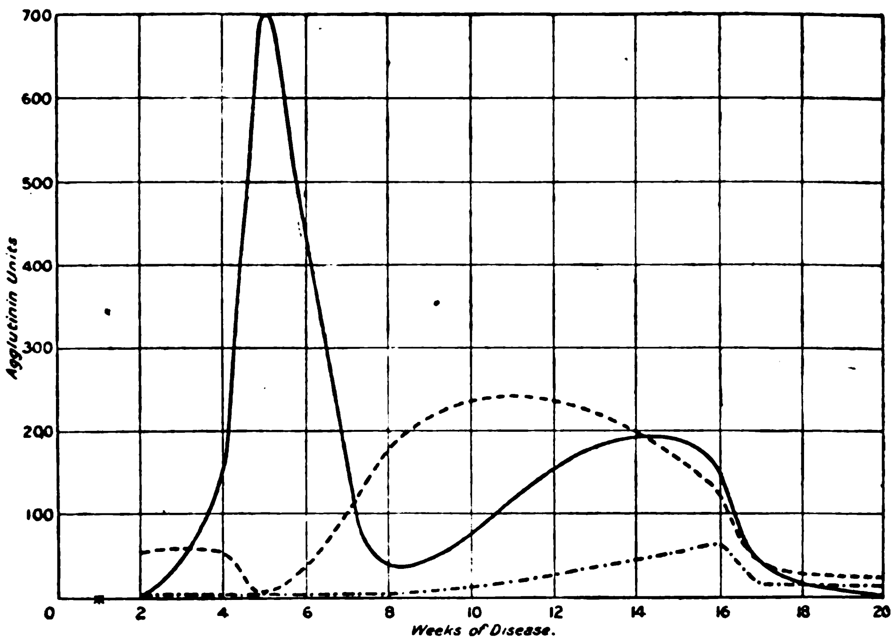

Chart D.—Weedan (see Table I, No. 10). Inoculated T.V. and T.A.B.

In Case 4, where the pyrexia lasted twenty-five days, agglutinins were absent on both examinations during the second and fourth week, the maximum production of para A agglutinins not occurring until the seventh week, while they were preceded by a rise in *B. typhosus* during the sixth week.

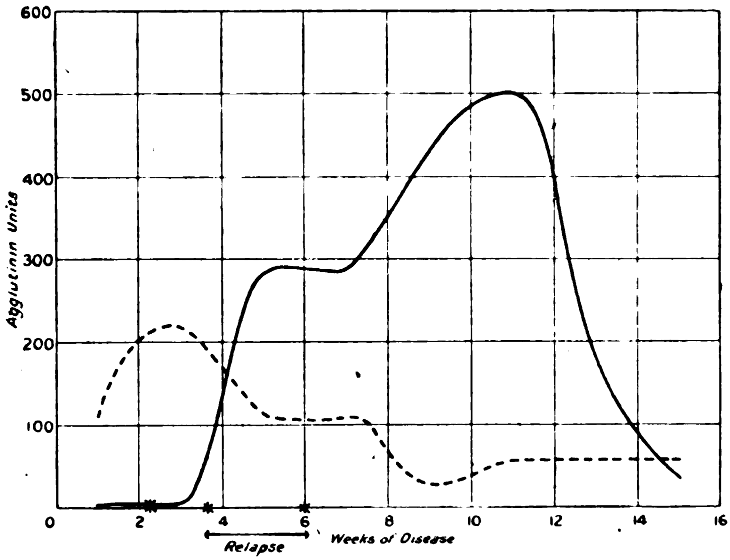

CHART E.—Coen (see Table I, No. 17). Inoculated T.A.B. Para. A isolated from fæces.

Case 8, another instance in which *B. paratyphosus* A was isolated from the fæces, has the agglutinin curves graphically represented in Chart C. The patient first came under investigation almost at the end of his three weeks' fever, when the figures for the para A agglutinins were 250, as compared with 80 for *B. typhosus.* This was just at the commencement of the rapid production of para A agglutinins which increased until during the seventh and ninth weeks their estimation was 510 units. Thereafter followed a rapid fall, while an unaccountable rise occurred during the thirteenth week which could not be associated with any obvious clinical feature of the case.

No. 9 is interesting in that the pyrexia was indefinite although the man's clinical history was suggestive of an "enterica" infection of an ambulatory type. Here again para A agglutinins were high during the fourth to the sixth weeks from the onset of the illness.

Case 10 (see Chart D) was admitted with a diagnosis of appendicitis towards the end of the second week of his illness. There was a history of one week's fever. The Widal reaction to para A was altogether negative even in low dilutions on the fourteenth day, but there followed a marked production of agglutinins during the fourth and fifth weeks. After a rapid fall there was a subsequent slight rise during the twelfth to the sixteenth weeks. This is another of those cases in which para B agglutinins make their appearance in late convalescence.

TABLE II.—AGGLUTINATION TITRES OF CASES INOCULATED WITH T.V. ONLY.

No. of case	Name	Weeks since inoculation	Nature of inoculation	Duration of pyrexia	Organism isolated		Week of Disease (titre expressed in agglutinin units) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	Wood ..	91	T.V.	4 weeks, followed by relapse, 32nd to 39th day	Para A (fæces)	T.	0	..	60	..	12	0	..	40	..	..	..	..	100	..	100	..	..	..	100	100
						A.	0	..	80	..	650	285	..	15	..	..	..	..	30	..	30	..	..	..	20	30
						B.	0	..	0	..	0	0	..	0	..	..	..	..	0	..	0	..	..	..	0	0
2	Miles ..	56	T.V.	19 days	Para A (fæces)	T.	..	100	..	..	..	10	..	225	..	100	..	50	..	50	..	..	..	..	..	..
						A.	..	0	..	..	..	185	..	30	..	140	..	140	..	50	..	..	..	..	..	..
						B.	..	0	..	..	..	0	..	0	..	0	..	0	..	0	..	..	..	..	..	..
3	Calver ..	52	T.V.	4 weeks	..	T.	..	225	..	80	40	40	10	20	..	40	..	..	..	..	..	..	..	..	..	..
						A.	..	35	..	1000	35	70	140	70	..	70	..	..	..	..	..	..	..	..	..	..
						B.	..	0	..	0	0	0	0	0	..	0	..	..	..	..	..	..	..	..	..	..
4	Gray ..	70	T.V.	26 days	..	T.	..	20	..	80	..	..	100	..	1000	..	..	50	..	200	..	..	..	..	..	..
						A.	..	0	..	0	..	..	140	..	325	..	..	280	..	140	..	..	..	..	..	..
						B.	..	0	..	0	..	..	0	..	0	..	..	0	..	0	..	..	..	..	..	..
5	Wilson ..	65	T.V.	2 weeks	..	T.	20	..	..	100	..	10	20	..	..	..	..	..	..	..	..	..	..	..	..	..
						A.	3	..	..	0	..	145	15	..	..	..	..	..	..	..	..	..	..	..	..	..
						B.	0	..	..	0	..	0	0	..	..	..	..	..	..	..	..	..	..	..	..	..
6	Royce ..	106	T.V.	4 weeks	..	T.	0	..	..	0	..	..	360	..	100	..	..	..	..	..	..	..	..	220	220	..
						A.	0	..	..	180	..	..	214	..	0	..	..	..	..	..	..	..	..	3	6	..
						B.	0	..	..	0	..	..	0	..	0	..	..	..	..	..	..	..	..	0	0	..
7	Clewlow ..	100	T.V.	No record obtainable	..	T.	..	..	..	..	..	..	..	25	..	100	..	20	..	..	..	20	..	5	..	..
						A.	..	..	..	..	..	..	..	100	..	120	..	60	..	..	..	15	..	.15	..	..
						B.	..	..	..	..	..	..	..	0	..	0	..	0	..	..	..	0	..	0	..	..
8	Ormrod ..	50	T.V.	4 weeks	..	T.	..	..	12	..	12	..	50	..	..	25	..	..	..	..	..	..	..	..	..	..
						A.	..	..	25	..	35	..	190	..	..	5	..	..	..	..	..	..	..	..	..	..
						B.	..	..	0	..	0	..	0	..	..	0	..	..	..	..	..	..	..	..	..	..
9	Symonds ..	70	T.V.	2 weeks	Para A (fæces)	T.	10	..	..	..	20	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..
						A.	30	..	..	..	70	..	30	..	..	..	..	..	..	..	..	..	..	..	..	..
						B.	0	..	..	..	0	..	0	..	..	..	..	..	..	..	..	..	..	..	..	..
10	Wilkins ..	100	T.V.	2 weeks	..	T.	..	0	..	..	..	..	..	..	22	..	..	..	..	..	..	..	..	..	..	..
						A.	..	0	..	..	..	..	..	..	285	..	..	..	..	..	..	..	..	..	..	..
						B.	..	0	..	..	..	..	..	..	0	..	..	..	..	..	..	..	..	..	..	..
11	Harvey ..	100	T.V.	1 week	Para A (fæces)	T.	..	12	..	..	..	..	..	..	50	..	..	..	..	..	..	150	..	..	..	..
						A.	..	30	..	..	..	..	..	..	70	..	..	..	..	..	..	30	..	..	..	..
						B.	..	0	..	..	..	..	..	..	0	..	..	..	..	..	..	0	..	..	..	..
12	Portass ..	74	T.V.	2 weeks	..	T.	..	14	440	..	28	..	57	..	14	..	..	..	..	..	..	..	..	..	..	..
						A.	..	7	142	..	71	..	568	..	142	..	..	..	..	..	..	..	..	..	..	..
						B.	..	0	0	..	0	..	0	..	0	..	..	..	..	..	..	..	..	..	..	..
13	Berry ..	70	T.V.	3 weeks	..	T.	..	22	..	44	..	28	..	44	..	..	..	..	..	..	..	..	..	..	..	..
						A.	..	142	..	280	..	142	..	280	..	..	..	..	..	..	..	..	..	..	..	..
						B.	..	0	..	0	..	0	..	0	..	..	..	..	..	..	..	..	..	..	..	..
14	Hendry ..	Not inoculated		10 days	..	T.	10	5	5	10	20	20	..	..	20	..	20	..	..	..	..	..	..	..	..	..
						A.	0	0	30	37	5	37	..	..	30	..	30	..	..	..	..	..	..	..	..	..
						B.	0	0	0	0	0	0	..	..	0	..	0	..	..	..	..	..	..	..	..	..

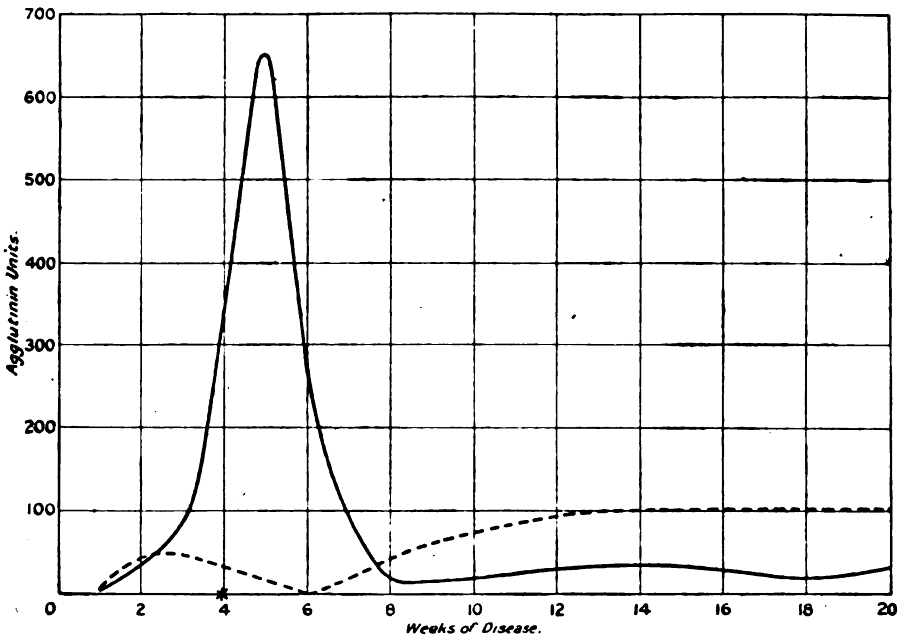

CHART F.—Wood (see Table II, No. 1). Inoculated T.V. Para. A isolated from fæces.

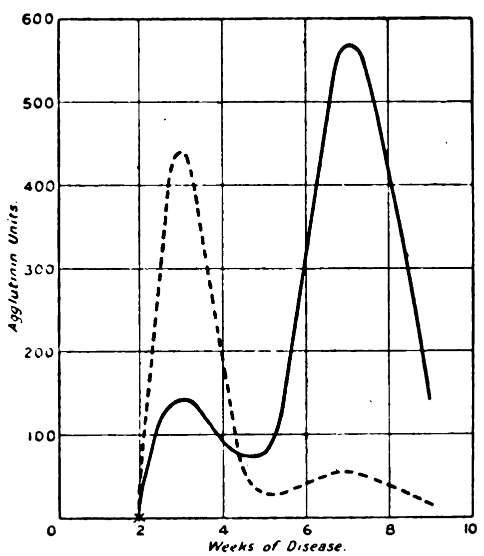

CHART G.—Portass (see Table II, No. 12). Inoculated T.V.

In Case 11, in which no agglutination examination was done until the sixth week when the continuously remittent fever was dying down, a marked production of para A agglutinins was recorded in the eighth week, while a high figure—420 units—was also obtained in the twelfth week. *B. paratyphosus* A was isolated from the fæces during convalescence.

No. 12 is interesting in that a relatively low figure for all agglutinins was obtained at the various examinations, although *B. paratyphosus* A was isolated on numerous occasions from the stools. Of course there is the possibility that the high figure may have been missed when it is recollected that the rise is often rapid and short-lived, and in this case the examinations were unfortunately made only at fortnightly intervals. This observation applies also to certain of the other cases where the agglutination reactions were carried out at irregular or infrequent intervals.

Case 13 shows the maximum production for *B. paratyphosus* A in the sixth week with a persistently high figure until late in convalescence, viz., sixteenth week. The para A bacillus was isolated from both the blood and fæces. No. 15 is noteworthy in being a case of jaundice, a sequela to *B. paratyphosus* B infection, the organism being isolated from the fæces in this laboratory. The patient's fever had lasted fourteen days, and he first came under our observation in the sixth week of illness, when the record for para B agglutinins was 571 units. Although para B agglutinins were on all five examinations distinctly more marked than the agglutinins for both *B. typhosus* and *B. paratyphosus* A, yet it is to be noted that para A agglutinins were distinctly present, a higher agglutination titre being recorded than that for *B. typhosus* in four out of the five agglutination tests.

In Case 17 we have clinically a sixteen days' typical enteric type of fever followed by a continuously intermittent temperature from the twenty-fourth to the forty-fifth day. Agglutination tests for *B. paratyphosus* A were completely negative during the first and third weeks (see Chart E). In the fifth week para A agglutinins were quite marked, and continued to increase up to the ninth and eleventh weeks, after which a rapid decline occurred. *B. paratyphosus* A was isolated during convalescence. It is to be noted that para B agglutinins were consistently absent during all the eight agglutination tests, although T.A.B. inoculation had taken place only six weeks previous to the onset of the fever.

The following are the most interesting cases of Table II, that is, of the patients inoculated with anti-typhoid vaccine only. Case 1 (see Chart F) is a long continued fever of four weeks' duration followed by a relapse from the thirty-second to the thirty-ninth day during which *B. paratyphosus* A was isolated from the fæces. Nine agglutination tests were altogether performed between the first and twentieth weeks, the result being altogether negative on the third day, while para A agglutinins reached their maximum production during the fifth and sixth weeks. No preliminary rise in *B. typhosus* agglutinins was detected here, although it may have occurred during the second week when no examination was made.

Case 2 is interesting in being an example of the type of case in which no para A agglutinins, even in low dilutions, were present on the fourteenth day, the figure for *B. typhosus* being 100 units. The case was clinically one of the "enterica" group, but no blood for another examination was obtained until the sixth week when para A agglutinins equalled 185 units, while they were persistent until the last examination made in the fourteenth week from the commencement of the fever. *B. paratyphosus* A was isolated from the fæces in the sixth week.

Case 4 is a similar case to the last, no para A agglutinins being present on the second and fourth weeks, the fever lasting twenty-six days. Lower dilutions than 1 in 25 were not put up in this case. In Case 6 the para A agglutinins almost entirely disappeared after being markedly present in the fourth and seventh weeks. No. 7 is one of those cases in which the patient was admitted to this hospital with a diagnosis of typhoid fever. (Report received: Widal positive to *B. typhosus* 1 in 250 in Mesopotamia). Our first examination made in the eighth week gave a figure of 100 units for para A agglutinins which were persistently present until the last examination on the eighteenth week. Moreover, it is to be remembered that the patient had had T.V. inoculation only. In Case 12 (see Chart G) with a typical fever of fourteen days the highest agglutination titre for para A was not recorded until the seventh week when a figure of 568 units was obtained.

Case 14 is one of the most interesting of the series. He had never been inoculated, and while in this hospital convalescing from benign tertian malaria he developed a ten days' fever of a typical enterica type with concomitant symptoms. The agglutination test on the third and tenth days respectively gave a figure of ten and five units for *B. typhosus*, while para A agglutinins even in low dilutions were altogether absent. On the twenty-first day, i.e., eleven days after the patient became febrile, the production of para A agglutinins amounted to thirty units, and they were still present when the last examination was made in the eleventh week from the commencement of the fever.

Discussion of the Results.

The cases recorded in the protocols have all had agglutination reactions carried out with sufficient frequency to justify deductions being drawn as to the type of the infecting organism, while they at the same time demonstrate the late response of the para A agglutinins. It has been possible in fourteen out of the thirty-three cases to isolate the organism, so that the agglutinin curves can be correlated with the bacteriological findings in over forty per cent of the records. Although the numbers are relatively small, yet this confirmation of the serological findings by the isolation of the organism affords data sufficient for drawing certain deductions in regard to the period and persistency of production of para A agglutinins.

(*To be continued.*)

Clinical and other Notes.

RECENT DEVELOPMENTS IN ROYAL ARMY MEDICAL CORPS FRONT LINE EDUCATION.

By Lieutenant-Colonel GUY N. STEPHEN.
Royal Army Medical Corps.

One of the interesting by-products of this War has been the development of a vast amount of educational force. Evidence of its existence could be adduced from various quarters, but to establish his statement the writer need do little more than point to the geographical area which throughout has been the scene of chief activity.

In France and Flanders new methods of defence have necessitated the invention of new methods of attack, and vice versa, while the aggregation of huge numbers of men in an unaccustomed environment has led to the principles of wound treatment and disease prevention being applied on a previously unexampled scale. In this work nearly every form of science and art has played its part, the net result being that no one who survives the War can well leave France with his mental outlook unwidened and unpossessed of at least elementary knowledge of some subject not previously within his ken.

Regarding it as a whole the education has been unconscious—the result of taking part in the application of new methods, of witnessing their operation, of camp fire discussing of passing events. But much of it has also been intentional, the authorities having seen in many instances the need of securing the right use of some new method or some new knowledge by the establishment of a definite school. In fact, a spot map of the British war zone in France prepared at any time during the last two years would have shown it to be freely peppered with schools devoted to the teaching of one war subject or another.

In such directions the Army Medical Service, it need scarcely be said, has shown itself no less active than other branches, and the degree of success it has attained is well worth attention.

As an example the work of an Army (R.A.M.C.) School of Instruction may best be taken since the school has been sufficiently long established, as war-time goes, to have attained a wide reputation.

It began its work in a real school—one of the many splendidly built French educational buildings that have figured so largely in the work of the R.A.M.C. in France—which was being used as a habitation for a casualty clearing station. At this time, the end of October, 1917, some of its wards had already been closed owing to the frequency with which the neighbourhood was shelled, and when shortly afterwards it was entirely closed owing to the same cause, the school was moved to another casualty clearing station, which owing to the inactivity of the military operations then in progress had plenty of room at its disposal.

General Principles.

The general aims of the school may be described as including the following :—

(1) To provide instruction in improved methods of doing the work required of the Royal Army Medical Corps in front line areas.

(2) To put workers in these areas into touch with any knowledge that has been gained at bases or elsewhere and with which it is to their interest to become conversant, either because it has a bearing on their own work or on general grounds.

(3) To fill in the gaps which exist in the military education of so large a proportion of existing medical officers, and to furnish them with a wider view of the general aims of military medicine than they are likely to gain by work in any single medical or military formation.

(4) To break down the mental barriers which subconsciously arise between men, who, although all parts of the same machine, have very different duties assigned to them.

The means employed to fulfil these various aims and the subjects taught in connexion with them naturally vary with the classes to which the pupils belong. Of these there are several—officers, non-commissioned officers and men belonging to the Royal Army Medical Corps itself, or to the sister services of the various Dominion contingents; officers and other ranks belonging to the medical corps of the American and Portuguese Forces, and officers and "other ranks" drawn from combatant units of all the before mentioned forces.

The length of instruction also varies, but less widely. For officers and "other ranks" belonging to medical formation each course lasts ten days, while four days complete the course for combatants. In both cases the students arrive early in the afternoon of the day preceding the opening of the course, so as to have time to settle down comfortably, and they start off back to their units on the afternoon of the final day. The date of this final day is coincident in both courses, since the four-day course for combatants begins on the seventh day of the medical course.

The Army medical officers and "other ranks" told off to attend these courses are drawn mainly from among regimental medical officers, and from field ambulances and sanitary sections and squads, with a smaller proportion of officers belonging to casualty clearing stations or in charge of labour groups. The pupils from the combatant units are usually platoon officers, stretcher-bearers, and members of regimental sanitary squads, together with a few men employed or in training as regimental chiropodists.

For men belonging to sanitary sections and squads, as also for chiropodists, specialized instruction is provided, but the hours devoted to it are so arranged as to enable the men to share in the general instruction when this is of a kind likely to be useful to them. Much the same might be said indeed of the work of all the different classes of student, since for all are provided both specialized as well as general lectures and demonstrations.

In dealing with the combatant classes, the chief aim perhaps is to make them practically conversant with the best ways of rendering first-aid, and to impress on them the value of sanitation and show them how it can best be secured even in front line conditions; while the special lectures for medical officers deal with the new developments in the medicine and surgery of war. The general work covers pretty nearly the whole field of first line work, and invariably deals with methods of obviating shock.

Fitting in all the lectures and demonstrations is often a task of great difficulty, more especially since it is regarded as an essential principle that mental surfeit—

which inevitably leads to lack of attention—shall be avoided. Consequently, even though the particular form of instruction may happen nominally to be a lecture, it is made to assume as far as possible the character of a demonstration and is invariably limited in point of time to well within an hour.

The authorities moreover do not aim at achieving results solely by lectures and demonstrations. A part at least of the object of the latter is to create such active interest in the subjects to which they relate that the students shall subsequently discuss among themselves and with the staff the various points raised, and thus act as instructors to one another. The general aim, in short, is to promote "shop talk" from the beginning to end of each day.

The Day's Work.

The formal day's work begins at 8.30 a.m. and ends in the afternoon about 4.30 p.m. As will be at once noted it is not a long day, especially as allowance of time for breakfast and luncheon is generous. Nevertheless it admits of the delivery as a rule of two or three lectures and of a corresponding number of practical classes or demonstrations, and leaves the students quite fresh-minded enough to discuss things amongst themselves and take part perhaps in an organized debate on some subject, which though not forming part of the school course has a common interest for all. It is easy to theorize about front line work, but if one wants to learn in how many different ways the same piece of work can be performed, and to determine which is really the best of them, then attendance at one of these debates is highly to be commended.

The education provided by these debates and by the "shop talk" in general is entirely informal, but for disciplinary and other purposes the rest of the work is accompanied by a certain amount of ceremonial.

Discipline.

The passage of the day is marked by bugle calls and before the first morning lecture there is a roll call and parade, the students marching off in fours to their work. The actual beginning of each day's morning work is half-an-hour at "physical jerks" before breakfast, and the actual beginning of each afternoon's work is another parade and about half-an-hour's squad and company drill. The Commandant presides at all general lectures, and the lecturers or demonstrators do not enter the room until all the students are assembled. The latter stand at attention as the lecturer proceeds up the room, and when the lecture is over do not leave their places until formally dismissed. Otherwise than in respect of these details the whole course is conducted on informal lines, though in the mess hut the usual practices of well-run messes on active service are observed and a notice of them is posted in the ante-room.

An additional point worth noting is that in the case of all officers each course ends with as close a reproduction as possible of the pomp and circumstance of a regimental guest night in time of peace. The proceedings include, of course, the formal toasting of His Majesty the King; a band lent by some near-by division plays throughout dinner in the ante-room, and when the formal proceedings are at an end the guest-night gambols commence and continue till the Mess President gives the word for departure. The aim of this evening is not merely festive. No doubt it forms a very pleasant feature of the course, but the object of the authori-

ties is to promote a general feeling of *esprit de corps* and to give young officers some idea of the mixture of ceremony and of good fellowship which characterizes garrison and cantonment life in times of peace. The final proceeding of all—just before the luncheon bugle blows on the day of separation—is a short address by the D.M.S., followed by a formal inspection and a march past.

Administrative Details.

Having thus set forth the general principles underlying the work of the school, it remains to supply a few details as to the administrative side of the enterprise and the choice of subjects for instruction.

Accommodation.

The school considers itself full when its "medical" students number 40 officers and 60 "other ranks," and its "combatant" students 10 and 130 respectively.

The requisite number for each course is secured by the D.M.S., who at the beginning of each course distributes the accommodation for the following course among the various units of the command. As the courses are very popular, it is only through accidental circumstances that vacancies are ever left unfilled.

Rations and fuel are drawn for all in attendance and officer students contribute to the mess fund a fee of 7.50 francs, and pay 2.50 francs per diem in addition. The fund thus formed has hitherto amply sufficed not only for the upkeep of the mess, but also for the provision of the various appliances required for demonstration purposes. The linen and crockery used in the officers' mess hut were lent by the British Red Cross Society.

The school buildings are formed by empty huts belonging to the casualty clearing station in which the school does its work. The principal lecture room is a French-pattern hut measuring ninety feet by thirty feet. The principal demonstration hut was formerly a recreation room. There is also a hut used by the officers as sleeping quarters, one for non-commissioned officers and two others for men. All ranks bring their ordinary camp kits, the officers placing these on bedsteads belonging to the casualty clearing station, while trestles and stretchers with palliasses are provided for non-commissioned officers, and stretchers, with palliasse mattresses beneath, for the men.

One cook-house serves all three messes and also such part of the casualty clearing station as is still used. The latter has been mainly utilized during the past winter for local sick and for cases of bomb injury among the civilian population in the neighbourhood.

The school office is the orderly room of the casualty clearing station. The arrangements for demonstrations were built by the Sanitary Section in whose area the school lies. The horses used are drawn from various field ambulances in the command, and are changed at the beginning of each course. For demonstrations in approved methods of field cookery, the students attend a cookery school a few miles distant.

Personnel.

From the foregoing details it will be seen that in the matter of housing, equipment and upkeep, the school costs nothing, since everything that it uses is either lent to it by some other formation or is provided by moneys resulting from its own existence.

An equivalent statement may be made in regard to the establishment of the school, since everybody who takes part in its tutorial or other work is either on temporary loan from another unit or is voluntarily performing school work in addition to other duties.

Subject to this consideration, the teaching staff may be said to consist of a commandant, an instructor, an adjutant, a quartermaster, 3 warrant officers, 5 serjeants, and a number of visiting lecturers. In addition there are 2 cooks, 1 corporal, 1 bugler and about 33 privates.

The commandant is also commanding officer of the casualty clearing station in which the school does its work. The adjutant is on loan from a field ambulance, and the instructor is a surgical specialist lent by one of the less active casualty clearing stations not far away.

Of the warrant officers, two are loaned from field ambulances to which they return for the four days which elapse between the courses. Both have had pre-war experience as instructors in physical exercises and bandaging respectively. The third warrant officer belongs to the A.S.C. attached to a field ambulance; he takes charge of the horse-lines and also acts as assistant riding-master.

Of the five serjeants one is in charge of the lecture rooms and is responsible for everything required at lectures and demonstrations. The other four are men who have distinguished themselves by their aptitude at a first course, and are retained at a second course to act as pupil teachers. All five are on loan from R.A.M.C. formations.

The corporal, the two cooks and the bugler are part of the ordinary establishment of the casualty clearing station. Of the privates about 12 are A.S.C. drivers lent by field ambulances and sent with the horses simultaneously loaned, in the proportion of 1 groom to every 2 horses. Of the rest, 4 act as assistants to the serjeant in charge of the lecture rooms, 2 as guards in the horse-lines, and the rest as mess servants and batmen. All these belong to the category of "B" men, that is to say they are men fit for ordinary fatigue work but not for duty with fighting troops. One batman is found to be sufficient for every six officers, and it is a rule of the school that they should not be "tipped."

As for the visiting lecturers, some take part in the work of every course, and others help only at one course or deliver merely a single lecture. Of the former the principal are the D.M.S. of the Army, its consulting physician and consulting surgeon, an officer in charge of one of the mobile laboratories, and the officer in sanitary charge of the area in which the school is situated.

The other visiting lecturers are drawn from any source in or out of the Army that is available. Men distinguished in some particular line and likely to be interesting are invited.

Subjects Taught.

The tuition afforded by the school is identical at each course only within certain limits; that is to say the field of work is always the same, but it has not hitherto been found practicable to give every yard of it the same amount of attention at each course. This is partly because the school has to depend a good deal on chance assistance, partly because, except in regard to a few subjects, it has not yet been decided exactly what knowledge should and can be secured in every pupil in the limited time at disposal.

The difficulties that exist in this connexion may perhaps best be suggested by giving a list of some of the titles of lectures and demonstrations that have been given since the school first opened its doors last November. The subjects invariably taught can be considered subsequently. Roughly classified, the list is as follows:—

Professional.
The Obscure Diseases of War.
The Treatment of Wound Shock.
The Surgery of War Wounds.
The Pathology of Gas Gangrene.
The Variety and Recognition of Shell and Drift Gas Cases.
The Meaning and Importance of Pyrexia of Unknown Origin.
The Early Treatment of Gunshot Wounds of Chest.
War Neuroses.
Wound Infections and their Complications.
The Objects of Medical Research.
Medical Clerking and Records.
Indents and how to prepare them.
The Duties of Regimental Medical Officers.
Relation of Royal Army Medical Corps Officers to other Officers.

Horse Mastership.
Horses, Sick and Well.
Saddle-fitting.
Horse Mastership.
Stables, Horses and Saddlery.

Law.
Military Law.
What is Evidence?
Offence Reports.

Lectures for Other Ranks.
The Duties of Other Ranks in Camp.
Duties on the Line of March.
The Duties of N.C.O.s
Relations of N.C.O.s to Officers and other Ranks.

Organization.
The Prevention of Disease.
The Prevention of Medical Diseases in War.
Organization of the Medical Services.
Organization of the Lines of Communication.
The Rôle of the Rest Camp.
The Return of Convalescents to Duty.
The Prevention of Sick Wastage.
The Working of Casualty Clearing Stations.
Motor Transport.
Billets and how to get them.

Miscellaneous.
Marching and the Care of Feet.
The Prevention of Trench Foot.
The Hygiene of Foodstuffs.
The Carriage of Casualties from the Fighting Line
Stretcher Carrying in Duck-board areas.
Stretcher Carrying in and out of Trenches.

The Field Pannier and its Contents.
Water-carts and their Upkeep.
Vapour Baths and their Use.
The Meaning of Conservancy.
Methods of Rechauffement.
The Prevention of Shock.
The Customs of the Service.
The Chaplains Department and its Relations.
Map Reading.

Many of these lectures and demonstrations, though differently entitled at different courses, really cover much the same ground; and judging from the time-tables of a number of courses, the authorities would generally seem to aim at securing in each course 3 or 4 lectures on surgical and medical subjects, half-a-dozen on questions of administration and organization, 2 on horse-mastership, and 1 or 2 on military law.

The subjects invariably taught are the application of the Thomas splint with special reference to the prevention of shock; the application of the rifle splint; the arrest of hæmorrhage; the use of the triangular bandage; and the construction and use of field sanitary appliances. In addition, all ranks take part in physical exercises and ordinary drill, and all medical officers are given riding lessons, and attend demonstrations of useful ways of varying the use of the food-stuffs issued as rations.

These subjects are mainly dealt with by practical classes. For none of these is it claimed that any particular method taught is necessarily the best that might be conceived; merely that it is a good one. When large bodies of workers are in question a good method with which all are familiar is better than an "improved" method known only to a few.

In regard to the Thomas splint course, the surgical view instigating this teaching is the one now universally accepted in France. Immobilization of parts before evacuation from an advanced dressing station, or even a regimental aid-post, should be secured in all cases of fracture of the femur, in extensive flesh wounds of the thigh, in injuries to the knee-joint, and in severe fractures in the upper part of the tibia; and the Thomas splint is the best to use, except when a fracture of the femur is complicated by an unusually extensive wound in the buttock or upper part of the thigh of such a kind as to interfere with the fitting of the ring. The method of application taught secures attention to the value of warmth and of absence of pain in the prevention of shock, and does not involve the removal of either clothes or boots or exposure of the wound until complete immobilization is achieved. It also assumes that the operator will have not more than two assistants, possibly only one.

The principle on which it is taught is that in applying the Thomas splint in the circumstances of an advanced dressing station or regimental aid-post no thought should be necessary but every movement automatic. To secure this result the whole process has been worked out in the form of a definite drill in which the various groups of movement are indicated by numbers. Presumably it will be described in detail separately in the Journal, so it suffices here to say that it covers everything from the initial warming of the patient by blankets and a primus stove (this being movement No. 1), to fixing the splint to a suspension

bar on the stretcher, and the placing in position for the journey of hot bottles and blankets (these being movements Nos. 11 and 12).

As to the value of this drill it seems to be sufficiently indicated by two facts: a man who knows it well can carry it out with entire efficiency in the dark; and in the competition with which the teaching of this subject always ends, teams of "other ranks" often beat teams of officers in perfection of detail and speed of completion. The former do exactly what they have been told to do and the latter use their "judgment" which may or may not be good. A first-class team can put up a limb perfectly in two minutes forty-five seconds, and an average team in about four minutes.

The teaching of the use of the rifle splint and the triangular bandage is of an equally practical kind and all classes of student take part in it. The arrest of hæmorrhage is taught by the D.M.S., who uses a mechanical appliance consisting of a set of tubes with forceps hung on a naked man to demonstrate the course of the principal vessels, the difference between arterial and venous bleeding, and how and where arteries can be controlled by finger pressure.

All classes receive instruction in sanitation, the number of sessions and the character of the teaching varying with their assumed initial knowledge. The appliances used for teaching purposes are models of those which have best stood the test of long experience. For the most part they have been evolved during the present campaign. They include methods of protecting food from contamination; disposing of excreta in different circumstances; and the destruction of parasites in clothing and equipment.

The drill and physical exercises absorb about one and a half hours each day. Besides securing due exercise in all ranks, they smarten up everybody all round. During the last three years many field ambulances have been paraded to receive the thanks of a Divisional or Army Commander for work done by them, and on such an occasion a proper sense of *esprit de corps* demands that nothing in the turn-out or movements of the men shall remind the visiting officer that ordinary drill enters little into their lives. At the drills the medical officer students are encouraged but not obliged to take command of sections or the whole parade. This is very useful because some of them have had no previous experience and many are rusty. A medical officer in charge of a party of stretcher-bearers or other group of men ought not to be dependent on his serjeant when he wishes to halt them, alter their direction, or move them out of the way of a passing lorry or a gun when marching along a road.

The riding classes take place every afternoon, every medical officer receiving four or five lessons. The work includes mounting and dismounting at word of command; maintaining pace and position, and negotiating a few small fences. All medical officers are supposed to be able to ride, but many of the pupils are entirely beginners; the fact that many of the horses used are a bit rough does not make the work any less useful.

Concluding Observations.

Opinion in France as to the value of the school is perhaps best represented by saying that at the time of writing several other armies are taking steps to duplicate it in their own areas. Should the War continue for another winter there is no doubt they will succeed, but in view of the apparent imminence of a

German offensive this is at present impossible. They can secure a sufficiency neither of pupils nor teachers except when military operations are so inactive as to allow men of both classes to be diverted from their ordinary operations.

Nevertheless, even should the Army (R.A.M.C.) School of Instruction shortly close its doors and never be duplicated, its existence will have been thoroughly justified: about 400 officers and 1,500 N.C.O.s and men have passed through the curriculum, and it has been shown how much can be done without either an elaborate establishment or an expensive equipment. It has provided many dozens of men with knowledge entirely new to them, and in others has crystallized knowledge which previously was vague; in all it has stimulated attention to a subject of the highest importance in front line work, namely, the preventive treatment of shock.

In conclusion, it may be said that a school of this order depends for its success little on its situation and not very much on the character of its visiting lecturers, but to an infinite extent on that of the resident staff. They must be men quite free from the schoolmaster spirit, but who are thoroughly conversant with their subjects, and capable of expounding them readily.

In particular, the commandant should be a man of wide sympathies, a gregarious person, a man whose knowledge of front line work is so complete that he can understand the point of view of all the different classes of pupils; a man naturally disposed to take his many small troubles cheerily, and to whom the various ropes of Army life are so familiar that he knows exactly which at any given moment he can leave slack and which tighten in order to maintain exactly the right admixture of discipline and ease. For one factor in a school of this order is that a course thereat should be regarded as a privilege and a pleasant break in front line life.

TWO VIBRIO SPECIES OF THE "PARACHOLERA" GROUP ASSOCIATED WITH A CHOLERA-LIKE OUTBREAK.

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It must be recognized that, besides the typical epidemic cholera of Asia, due to a vibrio with the biological characters of the classical *Vibrio choleræ* (Koch), cholera-like conditions may be produced by other vibrio species. As suggested by Castellani,[1] a choleraic disease causally associated with a vibrio which cannot be identified with the *V. choleræ*, might be designated paracholera. Of course, the cholera vibrio is capable of undergoing variations in its characters, and such variants are to be carefully distinguished from entirely different species. Thus the El Tor vibrio of Gotschlich (1905),[2] which differed from the classical type in

[1] *Brit. Med. Journ.*, March, 1916, No. 2,882, p. 448.

[2] "Scientific Reports, Sanitary, Maritime, and Quarantine Council of Egypt, Alex.," (1905, 1906).

producing a powerful hæmolysin, nevertheless reacted to a specific anti-cholera serum, and in virtue of its serological correspondence to the classical *V. choleræ*, has been regarded as a variety of the cholera species. It has also been asserted by various observers that strains of *V. choleræ* under certain conditions may lose their specific serological characters, e.g., agglutinability by an anti-cholera serum, so as to simulate non-cholera species; but it is generally accepted that the failure of a vibrio to correspond to the *V. choleræ* in this serological character is evidence that it belongs to an entirely different group.

The object of this communication is to describe the vibrio strains which were isolated from certain choleraic cases occurring in the form of a small localized outbreak in one of the convalescent hospitals in Egypt. In many of their characters these strains bore a distinct resemblance to the classical *V. choleræ*, but were easily differentiated by their serum reactions, and we have, therefore, classified them as paracholera vibrios.

Clinical Summary of the Cases.

On October 26 Pte. G., a patient convalescing from "pleurodynia," developed a sudden acute illness which presented the characteristic clinical signs and symptoms of asiatic cholera. The condition started with severe colic, followed by intense diarrhœa and vomiting, and severe cramping pains in the thighs and legs. The intestinal evacuations were typically "rice-water" in character. The acute stage was followed by a state of extreme collapse with subnormal temperature, low blood-pressure, sunken eyes, cold livid skin, and a weak, husky voice. He was treated in the collapsed state by intravenous injection of hypertonic saline solution, and subsequently made an uninterrupted recovery. It is of interest to note that this patient had been suffering from digestive disorder for six days previous to the onset of the choleraic illness.

The same day, October 26, another patient, Pte. B., in the same hospital, suddenly developed acute diarrhœa with abdominal pain and cramps in the legs, but the illness was not so severe as in the first case, and was not associated with any degree of collapse, though the blood-pressure was relatively low. This man had been suffering for some months past from recurrent diarrhœal attacks.

On the following day, October 27, three other patients in the hospital, Pte. C., Trpr. W., and Pte. P., developed acute choleraic diarrhœa. In the case of Pte. C., the condition was associated with abdominal pain and vomiting, but without marked collapse. The intestinal discharges were of the "rice-water" type. Unlike the other cases, the diarrhœa persisted after the acute phase. On October 31 typical dysenteric (blood and mucus) stools were passed, and the temperature rose to 100° F. *B. dysenteriæ* (Flexner-Y type) was isolated; anti-dysenteric serum was administered with rapid subsequent recovery. This man had been invalided from Mesopotamia with "anæmia," and, previous to the acute illness, had a slight diarrhœal attack in the convalescent hospital.

Trpr. W.'s illness did not amount to more than an acute but transient diarrhœa, with little general disturbance. This patient had an "enteric" illness in August. The day before the acute attack he had slight diarrhœa.

Pte. P. suffered from a more acute diarrhœa, with vomiting, cramps in the legs, and some degree of collapse. He had "dysentery" in May, and several attacks of diarrhœa since that date.

On October 28, at midnight, an R.A.M.C. orderly, Pte. L., who had been in attendance on Pte. B. the same day, suddenly developed an acute choleraic condition, which was more or less similar to that of Pte. G., and was associated with marked collapse. His evacuations during the acute stage were typically "rice-water" in character. He, however, made a good recovery after two days' illness.

From all the cases vibrios were isolated. In the cases of G., L. and P. large numbers of vibrio-like organisms were quite evident on microscopic examination of the discharges.

On November 1 another patient in the hospital developed an acute cholera-like illness. The diarrhœal stage, which lasted about eleven hours, was followed by a collapsed state with complete cessation of the diarrhœa. The first stool passed after this, about twenty-four hours after the onset of the illness, was examined, but no vibrios were detected. Specimens of the earlier evacuations were not obtained for bacteriological examination.

In the case of G., vibrios were detected on the first and second days, but were found to be absent on the third day from the onset of the illness.

In the other cases also the vibrios disappeared rapidly from the fæces.

The presence of vibrios in large numbers during the acute phase and their rapid disappearance after recovery was considered to be indicative of their causal relationship to the disease. From the clinical standpoint certain of these cases, particularly that of Pte. G., were quite characteristic of Asiatic cholera. Others were of a distinctly milder type.

Appropriate preventive measures were at once taken when vibrios were found in the first case; and after November 1 no further choleraic cases were reported.[1]

Isolation of the Vibrios.

Tubes of peptone water were inoculated from the intestinal discharges, and incubated at 37° C. for six to eight hours. On examination, they were found to represent an almost pure culture of actively motile vibrios. A loopful of the thin pellicle growth on the surface of the medium was introduced into fresh peptone water tubes, which were incubated for a period of about twelve hours. A practically pure culture was thus obtained by enrichment, and the strains were isolated from colonies on Dieudonné plates inoculated from the first or second peptone tubes.

The six strains corresponded in their morphological and cultural characters.

Morphological Characters. — Actively motile, comma-shaped organisms, measuring generally 1·3 to 2 microns in length and 0·4 micron in breadth. There was, however, considerable variation in size, and "S" forms were noted in young cultures. Films from older cultures showed the characteristic involution forms of the cholera vibrio. In preparations stained for flagella according to the method of Nicolle and Morax[2], a single terminal flagellum, about three times the long diameter of the vibrio, was observed.

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[1] A systematic examination of all the patients in the hospital revealed a number of healthy vibrio carriers. The carrier question in connexion with the outbreak is still under consideration, and will be dealt with in a later communication.

[2] Besson: "Practical Bacteriology, Microbiology, and Serum Therapy." Translated by H. J. Hutchens, p. 151.

Staining Reactions.—The vibrio was Gram-negative in young cultures. It stained well with the ordinary stains. In older cultures the staining reaction was faint.

Cultural Characters.—All the strains grew well on the ordinary media under aerobic conditions, both at 37° C. and at 22° C.

Stroke cultures on sloped agar, after twenty-four hours at 37° C., consisted of a moist whitish growth somewhat more abundant and more opaque than that of a *V. choleræ*. After two or three days it tended to assume a slightly brownish-yellow colour.

Colonies on agar, after twenty-four hours at 37° C., were moist white, somewhat raised, with a completely circular well-defined margin, and more opaque than those of the *V. choleræ*. The average diameter of twenty-four hours' colonies was two to three millimetres. After forty-eight hours they began to assume a yellowish-brown colour.

In gelatine stab cultures (15 per cent. gelatine) at 16° C. to 18° C., a white line of growth was apparent in twenty-four hours. In thirty-six to forty-eight hours' liquefaction had begun at the upper end of the stab, and by the third or fourth day a distinct cup had formed with a funnel of liquefaction extending down along the line of inoculation. Liquefaction proceeded more rapidly than in the case of the cholera vibrio, though otherwise the type of growth was similar.

In peptone water the vibrio grew rapidly, producing a thin pellicle on the surface, and at the same time a general turpidity of the medium. There was no apparent pigment production.

On MacConkey's and Dieudonné's Media.—Grew well, producing colonies which were somewhat larger than those of the *V. choleræ*. The colonies on MacConkey's medium, after forty-eight hours, showed a characteristic yellowish-brown colour, and were less raised and opaque than the colonies on ordinary agar.

On Alkaline Potato Medium.—An abundant moist white growth developed at 37° C. after twenty-four hours. In four or five days it assumed a characteristic pinkish-brown colour.

On solidified blood serum at 37° C. abundant growth and rapid liquefaction occurred, so that in thirty-six hours about three-quarters of the sloped medium was completely liquefied. A typical *V. choleræ* in the same time liquefied about one-quarter of the same amount of serum medium.

Bio-chemical Reactions.

The results of the fermentative tests were as follows:—

Glucose	Acid; no gas	Dulcite ..	No acid-production after ten days
Galactose	,, ,,	Adonite ..	,, ,, ,, ,,
Lævulose	,, ,,	Rhamnose ..	,, ,, ,, ,,
Maltose	,, ,,	Raffinose ..	,, ,, ,, ,,
Saccharose ..	,, ,,	Inulin ..	,, ,, ,, ,,
Mannite	,, ,,	Salicin ..	,, ,, ,, ,,
Dextrine	,, ,,	Sorbite ..	First day slightly acid; later alkaline
Glycerine	,, ,,	Milk ..	Slightly acid; no clot; later digested

Lactose .. At first no active production. After seven to ten days distinctly acid except in the case of Strain W.

Cholera red reaction (depending on the formation of nitrites and indol) was markedly positive after eighteen hours' growth.

Hæmolysis, tested by growing on blood agar, was slow, but quite evident after thirty-six hours.

Phosphorescence was absent.

SEROLOGICAL REACTIONS.

Anti-cholera Serum.

Agglutination.—There was no agglutination of any of the strains by a 1 in 50 dilution of an anti-cholera serum (Lister Institute), whose highest titre was 1 in 2,000. The agglutination test was repeated after the strains had been subcultured several times with a similar negative result. Similarly, strains isolated from the experimental animals (*vide infra*) also reacted negatively.

Complement deviation.—There was no deviation of complement by any of the strains in combination with the anti-cholera serum, though a marked complement deviation reaction was elicited in the case of a typical *V. choleræ*.

Patients' Sera.

Agglutination.—The sera of the six cases were tested seven days from the onset of the illness, both with the strain isolated and also with a *V. choleræ*. Pte. G.'s serum was found to agglutinate his own strain, and the *V. choleræ* in dilutions up to 1 in 200 after four hours.

None of the other sera reacted to the strain isolated or to *V. choleræ*. G. had been inoculated twice in January, 1916, with cholera vaccine. The serum of a healthy person, inoculated three months previously with cholera vaccine, did not agglutinate the same strain of *V. choleræ* in dilutions higher than 1 in 20, and did not act on strain G. even in a 1 in 20 dilution.

The development of specific agglutinins is strongly suggestive of the causal relationship of the vibrio to the disease with which it was associated. Of course this was the only case that reacted in this way, but it must be remembered that the agglutination reaction even in true cholera is somewhat variable, and, though often well developed in non-fatal cases, is frequently quite absent, as the protocols of Greig's[1] investigations show.

The phenomenon is therefore not a constant one, even in true cholera infections. As regards the concomitant reaction of G.'s serum to *V. choleræ*, it might be supposed that a re-exaltation of the post-inoculation agglutinins had resulted in an analogous fashion to that which occurs in the case of paratyphoid patients previously inoculated with typhoid vaccine (Mackie and Wiltshire).[2]

G.'s serum was re-tested a month from the onset of the illness. It was found that the end titre of the agglutinins for both strain G. and *V. choleræ* was now 1 in 100.

Agglutinating Anti-serum to Strains G. and L.

Rabbits were immunized by intravenous injection of successively increasing doses of cultures sterilized at 65° C. An anti-serum was in this way first obtained for strain G. and its agglutinating properties towards the other strains and also a typical *V. choleræ* were observed. The results are shown in the following table :—

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[1] *Indian Journ. of Med. Research*, January, 1915, vol. ii, No. 3, p. 733.

[2] Unpublished observations on the diagnostic interpretation of the agglutination test in typhoid and paratyphoid infections occurring among typhoid vaccinated troops.

Agglutinating Serum v. *Strain G.*

Strain:	1 in 100	1 in 200	1 in 400	1 in 800	1 in 1,600	1 in 3,200	No serum
	Dilution of serum						
G.	++++	++++	++++	+++	+	–	–
W. .. .	++++	++++	++++	++++	+++	–	–
P.	++++	++++	++++	++++	++	–	–
C.	++++	++++	++++	++++	++	–	–
L.	–	–	–	–	–	–	–
B.	–	–	–	–	–	–	–
V. choleræ ..	–	–	–	–	–	–	–

Readings made after four hours.
++++ represents complete agglutination, and the various degrees of partial agglutination by +++, ++ and +.

When it was found that strains L. and B. were not agglutinated by the anti-serum to G., an immune serum to strain L. was obtained and tested with the different strains and with *V. choleræ*. The results were as follow:—

Agglutinating Serum v. *Strain L.*

Strain:	1 in 100	1 in 200	1 in 400	1 in 800	1 in 1,600	1 in 3,200	No serum
	Dilution of serum						
G.	–	–	–	–	–	–	–
W.	–	–	–	–	–	–	–
P.	–	–	–	–	–	–	–
C.	–	–	–	–	–	–	–
L.	++++	++++	++++	++++	++	+	–
B.	++++	++++	++++	++++	+++	++	–
V. choleræ ..	–	–	–	–	–	–	–

Readings made after four hours.
++++ represents complete agglutination, and the various degrees of partial agglutination by +++, ++ and +.

These results clearly show that the six strains can be classified into two different species. Thus the immune serum to G. agglutinates G., W., C., and P., but has no action on L. and B., while conversely the immune serum to L. agglutinates L. and B., but has no effect on the representatives of the other species. Both types are also shown to be specifically different from *V. choleræ*. In this connexion it is of interest to note that L. was probably infected by contact with B. (*vide* Clinical Summary).[1]

PATHOGENIC EFFECTS ON ANIMALS.

Guinea-pigs: All the strains were tested by intraperitoneal injection of one-half of a twenty-four hours' agar-slope culture. Animals show signs of collapse after two or three hours, and died in four to six hours.

Post-mortem.—The abdomen was markedly distended, and the peritoneum contained great excess of fluid, which was turbid and in some cases blood-stained. Small intestine.—The mucosa and whole intestinal wall was inflamed: it contained no normal fæcal material, but was full of an opaque yellowish mucous fluid, slightly blood-stained; microscopic examination revealed large numbers of

[1] The strains isolated from the "carriers" (*vide supra*) have not yet been completely classified; some are agglutinated by the anti-serum to G., and some by the anti-serum to L.: others do not react to either. (These strains are still under investigation and will be dealt with in a later communication).

vibrios and abundant cellular exudate. Vibrios were recovered by culture from the heart blood, the intestinal mucus and the peritoneal exudate. These effects correspond to the action of certain cholera vibrio strains.

Pigeons: Two of the strains were tested by injection into the pectoral muscle of a one-fortieth of a twenty-four hours' agar slope culture. No pathogenic effect was produced.

Rabbits: The results in the case of the rabbit experiments were very striking and it was possible to reproduce a typical cholera picture post-mortem by intravenous injection of as small a dose as one-eightieth of a twenty-four hours agar-slope culture. The six strains for the different cases were all tested with similar results. In general, after injection of one-twentieth of a culture into the ear vein the animals died in about twenty-four hours or less. In one case, strain G., there was a marked diarrhœal condition before death.

Post-mortem: The small intestine contained no normal fæcal material; the mucosa was inflamed and the lumen distended with a white milky mucous fluid, or in some cases a blood-stained muco-purulent material. The intestinal fluid contained an abundant cellular exudate with masses of exfoliated epithelium. The inflammatory condition was usually most marked in the lower part of the small intestine. Cultures of the intestinal fluid on MacConkey's medium in some cases consisted of a pure growth of vibrios.

These animal experiments show a highly selective toxic action on the mucosa of the small intestine, and correspond to the pathogenic effects of the classical *V. choleræ*.

It will be seen from the bacteriological description that these vibrio strains closely resemble in many of their characters the *V. choleræ*, but that they are differentiated chiefly by their serological reactions. As regards the general cultural characters any difference which exists is quantitative rather than qualitative; thus the liquefaction of gelatine and solidified serum is more marked and the growth on the various media more abundant. The bio-chemical characters are in general similar. The hæmolytic test distinguishes these strains from the classical cholera vibrio, but, on the other hand, varieties of the cholera vibrio which respond to certain of the specific reactions have been shown to be hæmolytic,[1] e.g., Ruffer's Groups II and III, which are probably variants of the classical vibrio type. Group II was characterized by a positive agglutination and Pfeiffer's reaction, but complement fixation was absent. Group III shows absence of Pfeiffer's reaction, though the agglutination and complement fixation tests were positive.

It has been disputed by various observers whether agglutinability of a cholera vibrio by an anti-cholera serum is a fixed and constant character. Thus it was shown by Crendiropoulo[2] how inagglutinability might occur in the human body; he found that agglutinable vibrios in the fæces were succeeded after a time by inagglutinable vibrios in the bile. Greig[3] has shown how an inagglutinable water vibrio after isolation from the bile of an experimental animal tended to alter its

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[1] Ruffer, 1907, *Brit. Med. Journ.*, 1, p. 735, and Ruffer, Calmette, Gaffky, Geddings, Murillo, Praun and Potterin, 1911, "Le Diagnostic bactériologique du choléra," Paris.

[2] Crendiropoulo: "Recherches sur les vibrios au Lazaret de Tor," Alexandria, 1913.

[3] *Indian Journ. of Med. Research*, vol. iii, No. 3, January, 1916, p. 442.

morphological and serological characters, so that it approached more closely to the standard *Vibrio choleræ.* Chalmers and Waterfield[1] in a recent paper discussed fully the biological classification of the various types of vibrios, and concluded that the evidence was in favour of the agglutination test as a suitable means of differentiating the cholera group from other vibrios. The fact that anti-sera to strains G. and L., while strongly agglutinating homologous strains, fail to affect a typical *V. choleræ* which reacts to the anti-cholera serum is conclusive proof that these vibrios strains are specifically different from the cholera group.

As regards the identification of non-cholera vibrios, Chalmers and Waterfield have recently elaborated a system of classification in which they recognize the following groups: (1) Albensis; (2) Cholera; (3) Metschnikovi; (4) Gindha; (5) Finkler and Prior; (6) Drannani; (7) Terrigenus.

According to this classification our strains appear to correspond to vibrios of the Gindha group, defined as follows: "Vibrios, motile, aerobic, non-phosphorescent, growing in and liquefying gelatine, not producing pigment in peptone, not agglutinated by true cholera immune serum in 1 in 200 or greater dilutions, with growths in gelatine stabs resembling those of *V. choleræ*, and not causing death in twenty-four hours in pigeons when injected into the pectoral muscles in small quantities."

Chalmers and Waterfield described a vibrio strain of this type which they showed was causally associated with a case of paracholera occurring at Port Sudan in December, 1915, and identified it with the *V. Gindha* (Pfeiffer) which was found in the water of a well at Gindha (in Erythrea) where there had been an epidemic of cholera some months previously. In the same communication the various vibrio types which they recognized as belonging to the Gindha group were further classified. These included among other species the *V. Gindha* and the *V. Kegallensis*. The latter was described by Castellani as a paracholera vibrio, and was found by him to be associated with a cholera-like disease in Ceylon. Non-cholera vibrios have also been described from time to time in choleraic and diarrhœal cases by different observers, and Greig has described non-cholera strains in cases of "cholera," but as he failed to obtain any agglutination reaction by the patients' serum to these strains, and they were also noted in association with typical cholera vibrios, he had apparently disregarded them as causative organisms. It would be important that in future all such strains should be carefully identified and classified. With reference to the choleragenic properties of these paracholera vibrios it is of significant interest that a human experiment with the original *V. Gindha* resulted in a severe cholera-like illness.[2]

The *V. Gindha* was differentiated from the other members of the group according to Chalmers by (1) the power of reducing nitrates and forming indol—on which the cholera-red reaction depends; (2) the rapid liquefaction of blood serum. In the case of the *V. Kegallensis* the cholera-red reaction was absent.

According to these criteria our strains would correspond to the *V. Gindha*,

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[1] Chalmers and Waterfield, *Journ. of Trop. Med. and Hyg.*, No. 14, vol. xix, July 16, p. 165.

[2] Macé: "Traité pratique de Bactériologie." Sixth Edition. II, pp. 591-656. Paris. Quoted by Chalmers and Waterfield.

but they nevertheless present a striking difference from this type. Thus on alkaline potato medium they produce a characteristic pinkish growth, while that of the *V. Gindha* as described is of a maize-yellow colour. The cholera-red reaction differentiates our strains from the *V. Kegallensis*.

It appears doubtful if this system of classification is sufficiently complete for the identification of the paracholera vibrios. It is probable that this group comprises a number of different types or species, and that these may be classed and identified not only by their cultural characters but also by their specific serum reactions. Thus, of the six strains isolated by us from these choleraic cases, we have been able to show that four are specifically different from the other two, though all present similar cultural characters.

The evidence is strongly in favour of these strains being causally related to the cholera-like disease with which they were associated, and we have therefore classified them as paracholera vibrios. For future reference the two species, represented respectively by strains G. and L., might be designated *V. paracholeræ* A and B (Mackie and Storer, 1916).

MILITARY CATEGORIES IN DISEASES OF THE EAR.

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For the purposes of classification, a useful working system for defects of vision and ocular affections has been in existence for many years, but, so far as I have been able to ascertain, no uniform or practical scheme has been adopted for defects of hearing or diseases of the ear.

In attempting to supply this want I would venture to put forward the plan on which I have worked during the past two years.

The rough visual test of reading large type at a certain distance is easily carried out by the medical examiner at the recruiting centre or elsewhere in the case of men who have good vision, but when more or less gross errors of refraction and other defects are present, the valuation of these becomes the duty of the ophthalmic surgeon. Similarly, a man who in the compass of a large-sized room, say, twenty feet across, appears to readily hear without hesitation the various questions which it is essential to ask him and which are addressed to him in a quiet, even, conversational voice and in the absence of the history of any past or present suppuration, may be presumed to have normal hearing. But when such questions have to be repeated to him or the speaker's voice has to be raised, or a history of deafness with or without suppuration is given or ascertained, the case should then pass on to the aural surgeon for examination. It is with the latter type of case that I propose to deal.

I place them in two main groups as follows :—

(A) Deafness (without active suppuration).

(B) Suppuration (active with deafness).

Group A includes the following :—

(1) Middle-ear deafness: (*a*) Middle-ear catarrh; (*b*) otosclerosis; (*c*) past suppurations, but membranes well healed and no recurrences for many years.

(2) Internal ear deafness, which includes a family type.

(3) Mixed middle and internal ear deafness: (*a*) Advanced middle-ear catarrhal cases; (*b*) artillerymen, who have been exposed to long periods of intense gunfire; (*c*) some shell concussion cases, middle and internal ear lesions combined (*b* and *c* may also come under heading 2).

Owing to the vast complexity of our present military organization, a man with deterioration of hearing up to thirty or thirty-three per cent can be placed in low categories and may be usefully employed in labour teams with others who have good hearing, but those with grosser losses than this should be excluded from the Service.

Grades of Deafness.—Cases of deafness I place in four grades according to approximate loss of hearing, as 15 per cent, 20 per cent, 25 per cent, and 30 per cent to 33 per cent, which are graphically represented as follows: D1, D2, D3 and D4.

Grades of Suppuration.—Cases of suppuration are also placed in four grades and are graphically represented as follows: S1, S2, S3, S4.

*S*1.—In this grade there is some membrane loss, large or small, but the drainage is good. (Good drainage is the first and last essential in the treatment of suppuration.) The middle-ear cavity is dry or only slightly moist with mucus or pus. Occasional recurrences of suppuration may arise, usually with head colds, and are due to Eustachian tube infection from the throat, naso-pharynx or nose. The middle-ear cavity can be seen as a definite space beyond the free edges of the partially destroyed membrane, and is usually lined with epithelium and free from ulceration or naked granulations (vascular elevations not covered with epithelium). The deeper the middle-ear cavity, the better the ventilation and drainage facilities.

*S*2.—The membrane loss may be large or small, but the drainage is bad for one of the following reasons: (*a*) The membrane may show a small perforation situated a considerable distance above the floor of the middle-ear cavity; (*b*) the middle ear cavity is anatomically shallow and not a clear, deep, roomy space, free of the damaged edges of the membrane; (*c*) the membrane may be very little destroyed, but is adherent to the promontory and inner wall of the tympanum; (*d*) large granulation areas or polypi may obstruct the exit of pus from the tympanic cavity; (*e*) marked narrowing of the meatus due to chronic eczema and inflammatory pus infections of the meatal tissues is present.

*S*3.—Membrane loss, large or small, with bad drainage and in addition some inflammatory infiltration outside the limits of the middle-ear cavity, such as the meatal walls. When such disease exists posteriorly and superiorly, along the margin of the tympanum, the question of radical mastoid operation will arise, as well as the risk of the disease extending to the lateral sinus and cranial cavity, with any fresh exacerbation of the middle-ear infection. Cranial complications are, however, comparatively rare.

*S*4.—Cases similar to S2 and S3, but with definite symptoms and signs of labyrinthine irritation, with or without labyrinthine fistula.

This classification of cases according to anatomical features, facilities of drainage, site of lesion and extent of disease, is of considerable practical help in enabling

one to arrive at a fairly definite prognosis and to decide upon the best line of treatment.

Voice Tests for Hearing.—The common method of standing at measured distances from the patient and asking him to repeat certain words and phrases, whispered or spoken by the examiner, I never employ, because the man becomes conscious at once of being tested and if so disposed he will exaggerate or malinger. My routine plan is to sit at a table with a large note-book before me into which particulars of the cases are entered and the patient is seated about three feet away on my left, within easy reach for examination of his ears. He is freely interrogated in a quiet, even, conversational voice on all particulars pertaining to himself, such as rank, number, age, service, his duties now and those of his civil life and notes are made of the answers. The voice is not directed towards him, but at right angles to this line, and writing is continued, so that in this way he is not conscious of being tested. The voice is at times lowered and the effect noted. If in this way he appears to hear distinctly and without hesitation and needs no repetition of questions, he is not more than 20 per cent deaf. If he requires occasional repetition—say, one in four—he is 25 per cent deaf. A definitely Rinné negative patient who has full absolute bone conduction will require the occasional repetition of some questions. An exception to this rule will be found at times in certain cases of active suppuration where it is often noticed that they hear better when freely suppurating than when the disease is arrested. If questions have to be frequently repeated or the voice raised the hearing is 30 per cent or more deteriorated. If he gives a history of having been turned off drills and parades permanently for not responding to orders owing to deafness, his hearing is 30 per cent or more deteriorated.

Tuning-fork Tests.—The tests which I employ most and consider of greatest value in estimating degrees of deafness are Rinné's and absolute bone conduction. The C2 is the fork chiefly used and that of Lucae with a striker attached to the stem is the one which I employ. It can be heard by bone conduction (meatus open) for fifteen seconds, and by air conduction for twenty-five seconds. In the absolute bone conduction test the end of the fork stem is applied to the patient's mastoid over the antrum (his meatus being closed by finger pressure on his tragus) until he ceases to hear it, and it is then transferred to the examiner's mastoid, whose meatus is also closed and any difference in the periods for which it is heard is noted.

If bone conduction is full, Rinné's test is of considerable value in estimating middle-ear deafness, and about 8 per cent of the cases one meets with are of this type.

When Rinné's test is definitely negative and bone conduction full, I place the loss of hearing at 25 per cent approximately. The definite Rinné with full bone conduction is therefore taken as a standard of loss, and variations in air and bone conduction are estimated by comparison with this.

Summary of Tests.

Fork used, Lucæ C2 { B.C. (Bone conduction) = 15 seconds.
A.C. (Air conduction) = 25 ,,

D1, both ears { B.C. full.
A.C. shortened a little but longer than B.C. = Rinné plus = 10 to 15 per cent loss approximately.
Conv. voice : answers freely without hesitation.

D2, both ears { B.C. full.
A.C. and B.C. equal. Rinné = plus minus = 15 to 20 per cent loss approximately.
Conv. voice : heard without hesitation. }

D3, both ears { B.C. full.
A.C. definitely shorter than B.C. = Rinné minus = about 25 per cent loss }

(This is taken as the standard of depreciation for fixing percentages.)

Conv. voice: heard well, but occasional need for repetition of some questions.

D4, both ears { B.C. definitely shortened.
A.C. also shortened = Rinné plus, or plus minus, or minus = about 30 per cent loss. }

(Internal ear or mixed middle and internal ear deafness.)

Conv. voice: frequent repetition of questions and finally voice has to be raised, so much so that a person with normal hearing will hear it distinctly about 30 feet away.

How Categories are arrived at, New Classification (A, B, D, E).

One ear is normal, hearing equals 100 per cent.
Other ear is in grades D1, D2, D3, D4, 15, 20, 25 and 30 per cent loss.
When combined average loss of two ears is 10 per cent or under = Category A.
Combined loss (average) is about 10 to 20 per cent = B1. (Abroad, any theatre of war.)
,, average loss is about 25 per cent = B2 or B3. (Abroad.)
Average loss is about 30 per cent = B2 or B3 (Home Service.)
Above 33 per cent = E.
Suppuration, S1, = hearing D1 and 2, = B1. (North-West Europe.)
,, S1, = ,, D3 ,, 4, = B2 and 3. (North-West Europe.)
,, S2, = ,, D1 ,, 2, = B2. Hearing, D3 and 4 = Biii. (North West Europe.)
,, S3, = ,, D1 ,, 2, = B2. ,, D3 ,, 4 = B3 (Home Service.)
,, S4, = E.
Cases of S2 and S3 when the disease is active may be temporarily placed in Category D.

FIVE CASES OF METASTATIC GAS GANGRENE—THREE FOLLOWED BY RECOVERY.

By Captain J. V. J. HARTLEY.
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That micro-organisms, in cases of gas gangrene, gain entrance to the blood-stream and produce lesions in distant parts of the body, is perhaps of more frequent occurrence than is generally supposed. This in the majority of cases is a terminal phenomenon and readily escapes notice. Colonel Wallace [1] in his contribution on gas gangrene mentions two cases in which metastatic lesions were manifest shortly before death and two similar cases are recorded by Kenneth Taylor [2]. Mullally and McNee [3] describe a remarkable case in which the bacillus of malignant œdema, circulating in the blood, became localized at the sites of injections of A.T.S. and pituitrin. During the past five months, five cases of metastatic gas gangrene have occurred in — General Hospital and three of these are of special interest, inasmuch as each made a satisfactory recovery.

The records of the five cases are as follows:—

Case 1 (under the care of Captain W. F. Neil, R.A.M.C., T.C.).—Cpl. A. was admitted on September 9, suffering from gunshot wounds of right upper arm. The humerus was comminuted and the wound very foul and septic. December 6: Operation. Drainage improved and fragments of bone removed. December 9: The

arm below the wound became cold and areas of discoloration and bullæ appeared on the forearm and hand. The patient was pallid, complained of thirst and vomited. The pulse was soft and running. Operation: The arm was amputated at the shoulder joint, the flaps being left unsutured. The same evening, crepitation was noticed in the left buttock. The extremities were cold and the pulse barely perceptible. One hundred cubic centimetres of eusol were injected into the median basilic vein. Shortly afterwards the pulse improved and he began to perspire profusely. December 10: The improvement was very transitory. Thereafter he rapidly grew worse and died at 2 p.m. An autopsy was made, soon after death, and the gluteal muscles of the left buttock were found to be greyish, soft and crepitant. A bacteriological examination demonstrated the presence of *Bacillus aerogenes capsulatus* in large numbers.

Case 2 (under the care of Capt. W. F. Neil, R.A.M.C., T.C.).—Cpl. B. was admitted September 17 with a gunshot wound of the abdomen. An operation had been performed at the casualty clearing station, and the ascending colon had been found injured. On his arrival at the base he had a fæcal fistula. Further examination revealed swelling and crepitation over the right deltoid. There were also the usual toxic symptoms associated with gas gangrene—a soft, rapid pulse, intense thirst and marked pallor. The same day an incision was made over the right deltoid, and the whole of the muscle was greyish-brown in colour, crepitant and spongy. A free excision was made and seventy cubic centimetres of eusol given intravenously. The patient rapidly grew worse and died the next day.

Case 3.—Pte. L., aged 22, was admitted September 5 with gunshot wound of the right arm. The missile had traversed the upper arm a short distance above the elbow and comminuted the humerus. The entrance and exit wounds were large and the brachial artery lay exposed. The forearm and hand were cold and presented a bluish mottling and numerous bullæ. Crepitation was detected, and bubbles of gas and a sanious fluid could be pressed from below into the wounds. The patient was pallid, had a dry foul tongue, and vomited. Operation: The arm was amputated a little above the insertion of the deltoid, a flap being taken from the outer aspect. September 6: Patient extremely ill. Pulse 140, respiration 32, temperature 103° F. Stimulants freely administered and 100 cubic centimetres of eusol injected into the left median basilic vein. September 9: General condition slightly better although there was extreme pallor and an insatiable thirst. Pulse 110, temperature 101° to 103° F., respiration 30. The flap had become necrotic, otherwise the stump was satisfactory. Pain was complained of in the right buttock, and on examination there was found to be some swelling and a suspicion of deep crepitation. September 10: The crepitation very distinct and extending over sacral and right iliac regions and down the back of thigh to within a hand's breath of the knee. The right buttock definitely tympanitic, and over the most prominent part there was a small area of bluish discoloration. Operation: Under a general anæsthetic, an incision was made to the right of the sacrum. Gas was present in the subcutaneous tissue, and gas and sanious fluid could be expressed from the right buttock. September 16: At the site of the bluish discoloration a small circular slough of skin formed. To-day the slough was gently removed, and along with it was extracted a greyish necrotic mass of muscle measuring four inches by two inches. The patient was decidedly better. There was no longer thirst, and he was now able to enjoy his food. The temperature

was falling by lysis. Pulse 26, respiration 24. September 20: The arm stump and wounds of buttock were now covered with healthy granulations, the patient rapidly gaining colour and strength, and this day was transferred to England.

Case 4.—Pte. W., aged 21, was admitted December 23, suffering from trench feet. The toes were bluish-black and cold. There were bluish patches and bullæ on dorsal and lateral aspect of feet and œdema of legs extending as high as the knees. The blisters were snipped, the feet washed with methylated spirits and boric powder and dry gauze applied. December 6: The feet became sodden and foul smelling. The bluish patches became confluent and an indefinite line of demarcation formed at the level of the ankle joints. There was pallor and thirst and the temperature rose to 105° F. and the pulse to 120. Operation—The left leg was amputated midway between ankle and knee; the right leg was amputated a hand's breadth above the ankle and as there was a suspicion of gas in the intermuscular planes, the lateral incisions were extended upwards and the short flaps left unsutured. The patient's general condition was so critical that the operation had to be hurriedly completed. Before he left the table a mixture of 100 cubic centimetres of eusol and 200 cubic centimetres normal saline was injected into the median basilic vein. December 7: Œdema of legs subsiding and stumps satisfactory, patient however extremely ill, mildly delirious and passing urine involuntarily; there was a bluish pallor of the face. Respiration 46, pulse 140. No dyspnœa and nothing abnormal to be found in the chest. One pint of saline and one cubic centimetre of pituitrin given subcutaneously. December 8: Still delirious. Respiration 48, pulse 120, temperature 101° F. December 9: No longer delirious but very weak and pallid; complained of pain in buttocks; on examination a small serous blister was discovered on the left buttock. December 12: Slight improvement; stumps satisfactory. The sclerotics had developed a marked icteric tint. December 13: Still complaining of pain in buttocks and this evening another examination made; both gluteal eminences tympanitic. The skin over sacral and lumbar regions œdematous and over the posterior superior spine there was an area of bluish-red discoloration; this state of affairs was remarkable, as the patient's general condition was decidedly better. There was still the waxy pallor, but the patient was feeling better and the tongue was clean and moist.

Operation.—Under a general anæsthetic, incisions were made downwards and outwards from the posterior superior spine; the subcutaneous tissue was slightly œdematous. On incising the deep fascia bubbles of gas and a thin yellowish blood-stained fluid escaped; the finger was inserted and greyish crepitant masses of necrotic muscle extracted; the wounds were lightly packed with dry gauze. December 16: Buttock wounds douched daily with hydrogen peroxide and eusol gauze applied; small greyish tags of muscle slough were separating and exposing early granulating tissue. Portions of the flaps of the right stump had necrosed, otherwise the stumps satisfactory; patient feeling stronger, enjoying his food and sleeping well. January 2: Temperature now been normal for a week. Buttock wounds and stumps clean. For several days patient had been allowed up on a chair and this day was transferred to England.

Bacteriological Examination.—A fragment of slough was examined by Captain W. E. M. Armstrong, R.A.M.C., and was found to contain *B. aerogenes capsulatus* in large numbers.

Case 5 (under the care of Captain G. Whittington, R.A.M.C.).—Cpl. P.,

was wounded in the right buttock, right arm and right shoulder by shell fragments on December 10. On December 12 the buttock wound was enlarged at the casualty clearing station and a small piece of shell removed from the bone close to the right acetabulum. December 14: Patient admitted to the base hospital. He was not markedly pallid but complained of thirst. Pulse 92, temperature 99·5° F. The wound in right buttock was about three inches in length and lay a little above and behind the great trochanter. There was a moderate amount of sepsis, which, however, was localized to the immediate neighbourhood of the wound. Accidentally it was found that deep crepitation could be made out in the opposite buttock. There was no discoloration of the skin. Operation: An incision was made downwards and outwards from the left posterior superior spine of the ilium and gas and a thin blood stained fluid escaped. A portion of the gluteus maximus, measuring two inches by three inches was greyish and crepitant and was excised. The wound was lightly packed with dry gauze. December 18: There was still a small amount of thin purulent discharge from the left buttock. The discharge contained fragments of muscle slough and had a characteristic and anaerobic smell. General condition much improved. January 3: For more than a week there was irregular pyrexia and this was in part due to the septic state of the wounds of the left arm. Now all the wounds were clean and granulating and his general condition was such as to allow of his being transferred to England.

Bacteriological Examination.—Captain W. E. M. Armstrong, R.A.M.C., reported on the gluteal discharge, that *B. aerogenes capsulatus* was present in large numbers and that in aerobic culture a coliform bacillus had been isolated.

It will be observed that in all of the three cases in which a bacteriological examination was made, the causal organism of the metastatic infection was the *B. aerogenes capsulatus*. Four of the secondary lesions occurred in the buttocks and it would seem—as Kenneth Taylor pointed out in his two cases—that continuous pressure due to the patient's posture was an important factor in the localizing of the metastatic infection. Whether the intravenous injection of eusol in Cases 3 and 4 was contributory to their recovery, it is impossible to say. In Case 5 there was recovery without the injection of eusol, but the remarkable feature of this case was, that despite the evidence of a systemic infection with the *B. aerogenes capsulatus*, there was an absence of marked toxæmic symptoms.

It will be noted that in the fatal cases 1 and 2 the intravenous injection of eusol was given, when the secondary lesions were already manifest and the patient obviously moribund.

In the successful cases 3 and 4 the intravenous injection of eusol was given early. The metastases occurred late and recovery followed with the minimum of surgical intervention. In Case 3 the extensive gas gangrene in the right buttock and thigh occurred five days after amputation of the right arm. Only a small incision was made for the secondary lesion, yet the infection became localized and a muscle slough separated of its own accord. In Case 4 the metastatic infection in both buttocks developed a week after the amputation of the gangrenous feet. Here, again, the operation for the secondary lesion was limited and no attempt was made to extirpate the infected muscles. One can only suggest that

in these two cases the intravenous injection of eusol delayed metastasis, and that prior to the secondary lesions the patient had time to acquire an immunity sufficiently powerful to overcome the disease.

I wish to express my thanks to Captain Max Page, R.A.M.C., for his help and advice, and also to Lieutenant-Colonel S. G. Butler, D.S.O., R.A.M.C., for his kind permission to publish the above cases.

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PENETRATING WOUNDS OF THE CHEST.

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INTRODUCTION.

THE pioneer work in surgery of the chest under war conditions has already been done by Colonels Gray and Gask, of our own service, and by Duval, Courcoux and Gregoire, of the French. By laying down the principle that wounds of the chest require surgical treatment on the same general lines as other wounds, and by demonstrating that intra-thoracic operations can be performed on the recently wounded, with good prospects of marked benefit in suitable cases, they have brought chest surgery into prominence.

In the course of development of this new field of war surgery, many problems have arisen. Indications for operation must be better known, the best technique should be more generally agreed upon, questions of preliminary treatment and of after-care must be settled, the anæsthetic of choice must be determined, and more must be learned of the results of chest wounds, not only in cases that have come to operation, but also in those that have received only medical treatment.

Besides the problems with which the operator is directly concerned, there are those of diagnosis. They are interesting but elusive, because of the complexity of the lesion and the intricacy of signs resulting therefrom. Hence the necessity of co-operation with a radiologist of experience.

The high mortality from penetrating chest wounds in the forward

areas, constitutes at once a challenge to our profession, and an opportunity to save life. The writers above mentioned have shown that wise surgical intervention is destined to become increasingly valuable. Through further knowledge mortality can be lowered to the irreducible minimum, convalescence shortened in a larger proportion of cases, deformity diminished, and functional results improved.

Conditions of Work.

The cases upon which this paper is based were admitted to a casualty clearing station between July 31 and October 1, 1917. The chest surgery had to be subordinated at times to needs deemed more urgent, with the result that operations on the chest were not always performed as early as might have been desirable. As a rule, however, the operation was done promptly when indications for it were clear. Pressure for beds often necessitated too early evacuation of patients (see Table II). The work of examination, observation, and general care of the patients was performed at first by Captain Blankenhorn, U.S.R., and later by Major Shattuck.

It is a pleasure to express thanks to Captain Blankenhorn for his share in the work, and to recognize the services of several other surgeons who helped us out from time to time. Captain O'Neill, the radiologist, was of the greatest service in localizing foreign bodies and in elucidating complex intra-thoracic lesions. To him especially thanks are due.

Material.

Owing to the fact that fighting was almost incessant, and often heavy during August and September, the number of chest wounds admitted during this period was larger than would ordinarily have been the case in a corresponding period.

The time that elapsed between wounding and admission of the patient to the clearing station varied as a rule between six and twenty-four hours. There were exceptions both above and below these figures. The usual time was probably about twelve hours. Our work was based on the firm belief that all wounds of the chest should be considered from the standpoint of sepsis, and that early surgical intervention by eliminating the source of infection would diminish suffering and shorten convalescence.

Operative Technique in General.

Operations on the chest must be performed under the strictest aseptic conditions. Without speed one cannot expect the best results, but the operation should be thoroughly done if the condition of the patient permits.

Gas and oxygen is our anæsthetic of choice. A pre-operative "dope" of morphine $\frac{1}{4}$ grain and atropine $\frac{1}{120}$ grain was given half an hour before the patient was to be removed to the theatre.

Five per cent picric acid in methylated spirit was used to prepare the skin.

As to the site of operation, one is guided by the position of the wound or wounds, and when a missile is lodged in the thorax, largely by the radiologist's findings, the question usually arises whether to perform a thoracotomy through the wound or to choose an uninjured situation.

If the missile is situated in a portion of the lung or pleura accessible through the wound, we believe it is sound to excise the entrance wound, completely removing all injured tissues and bone fragments, and then after changing gloves and instruments to make an incision six inches long through the wound or from either end of it.

The incision is carried down to the bone, the periosteum is incised for a length of at least four inches and separated from the bone with a periosteal elevator. Then four inches of rib are removed with rib shears. The posterior periosteum and parietal pleura should be divided in the mid-line of the space left by the removal of the rib. Observance of this point facilitates closure of the wound afterwards.

The next procedure is to evacuate the hæmothorax. This can be done by turning the patient on his side, but it is safer to mop out the hæmothorax by means of a long roll of gauze introduced on long forceps. Thus can be avoided the danger of a serious fall in blood-pressure, which seems to result occasionally from rolling the patient while the chest is open. An example of what is meant appears in Table V, Case 2.

TABLE V.—EFFECT OF IRRIGATION ON THE BLOOD PRESSURE.

Case 1.—Shrapnel Wound Chest: Suture of Diaphragm.

	Systolic	Diastolic
Before	120 ..	80
Under	130 ..	75
Lavage	120 ..	80
Closure	105 ..	65
End	80 ..	60

Case 2.—Shrapnel Wound Chest: Shell removed Pleura.

	Systolic	Diastolic
Before	100 ..	55
After	95 ..	45

Averages of three readings.

Case 3.—Shrapnel Wound Chest: Secondary Drainage.

	Systolic	Diastolic
Before	125 ..	50
After	135 ..	45

Case 4.—Shrapnel Wound Chest: Entrance only.

	Systolic	Diastolic
Before	105 ..	70
Resection	120 ..	80
Lavage	115 ..	70
Closure	120 ..	65
End	115 ..	65

Case 5.—Shrapnel Wound Chest: Staphylococcal Infection.

	Systolic	Diastolic
Before	100 ..	50
After	100 ..	55

Averages of three readings.

Case 6.—Gunshot Wound Chest: Suture of Lung.

	Systolic	Diastolic
Before	110 ..	50
After	105 ..	50

Note.—It will be seen that except in the first of these cases, irrigation made practically no difference in the blood pressure.

One of the best retractors for the chest is that of Tuffier. After it has been adjusted the hand is introduced into the thorax to search for the

missile. When the foreign body is embedded in the lung substance, lung-forceps are used to deliver the damaged portion of lung to the wound, so that bone fragments, the missile, and other foreign matter can be removed. The damaged portion of lung is excised, the wound swabbed with spirit, and a small quantity of "bipp" rubbed into it. Then, fine catgut sutures are introduced on a round-bodied needle, with a needle holder.

Finally, the pleural sinus is cleared of all blood-clot, and irrigated or swabbed as clean as possible before closure. In most of our cases, warm saline or Dakin's solution was used for irrigating. In a few cases 1/1,000 flavine solution was employed, and occasionally, after saline irrigation, "bipp" and liquid paraffin mixed in the proportion of ½ ounce to six ounces was introduced. In a small number of cases the cavity and pleural sinus was simply swabbed with gauze wrung out in warm saline, and followed with swabs soaked in spirit.

We believe that when "bipp" is left in the pleural cavity, a marked pleural exudation results, in consequence of which early aspiration is demanded. The swabbing method is probably as efficacious as any other. It has the advantages of simplicity and harmlessness.

The toilet of the pleura completed, the chest is closed in layers, the first layer being a muscle pleural one. When the skin has been sutured, the line of the incision is painted with picric acid solution and a mastisol dressing applied. Over this a thin layer of absorbent cotton-wool and a many-tailed binder are applied. The binder should not be so tight as to prevent expansion of the chest. After twenty-four to forty-eight hours, as a rule, the binder can be removed. One can then examine the chest with much less disturbance to the patient.

When thoracotomy is not done through the wound, for best access to the lung and pleura one commences the incision from the posterior axillary line, and carries it forward at least six inches.

The rest of the operation is followed as in thoracotomy through the wound.

One point requires emphasis, namely, that while intra-thoracic manipulations are not actually being carried out, the opening into the thorax should be closed with a plug of gauze, to minimize disturbance of respiration and of circulation.

The chest theatre, when possible, should adjoin the chest wards, in order to avoid the exposure of the patient before and after operation, which is difficult to prevent entirely in bad weather, when the patient has to be carried outside to and from the theatre.

Type Operations.

(1) *Parietal.*—The parietal operation consists in complete excision of the wound in the parietes, removal of dirt and fragments of clothing and of bone, and trimming of the broken ends of ribs, followed by thin smearing with "bipp" and closure of the wound, if recent enough.

(2) *Thoracotomy.*—The "complete" operation is performed as follows: A large resection of rib is made either through the wound or through an uninjured part. The missile, if large, i.e., approximately ½ by 1 inch or more in size, is removed when accessible; bone fragments, if present, are removed from the lung, the lung wound is sutured if necesary, and these procedures are followed by lavage and closure.

(3) *Drainage.*—Drainage may be primary or secondary. When the infection has become established to a marked degree, primary drainage is usually resorted to. Such cases are usually late arrivals at the clearing station, having probably lain out for many hours or even days, or been detained at a field ambulance on account of their serious condition. Secondary drainage is performed for established infection which resists conservative treatment.

(4) *Lesions of the Diaphragm.*—The diaphragm can be easily reached by making an incision along the line of the sixth rib from the mid-axillary line, as far as the costo-chondral junction. The costal cartilage is divided at least ½ an inch internal (nearer the mid-line) to the costo-chondral junction, care being taken not to injure the subjacent pleura. By dividing the intercostal muscle along the lower border of the rib, and then making traction on the sixth rib upward with a retractor, the intercostal space can be enlarged. Then, after dividing the pleura along the middle of this space, and introducing a retractor of the Tuffier type, one finds easy access to any part of the diaphragm. Through the diaphragm one can reach the track of a missile in the liver. The diaphragm can be readily sutured with catgut, by means of a curved needle and needle-holder. The chest should be closed with a muscle-pleural suture of catgut, and the costal cartilage repaired by one or two sutures of strong gut. The advantage of this operation lies in the fact that the chest wall is replaced in its entirety, and that the post-operative distress which follows rib resection is conspicously absent.

(5) *Subscapular Lesions.*—Frequently there is much damage to the chest-wall, deep under the scapula, and trephining of the scapula is most unsatisfactory. The best method is to displace the scapula from the vertebral border by dividing the rhomboids and serratus magnus with an incision extending the full length of the scapula. It may be necessary to ligate the posterior scapular artery, and to divide the slip of the latissimus dorsi inserted into the angle of the scapula. The scapula can then be moved upward and outward, so as to give access to the chest wall beneath it. The muscles can be sutured afterwards, and little interference with scapular functions ultimately results.

(6) *Exposure of the Pericardium.*—A curved incision is made from the middle of the sternum, along the line of the sixth costal cartilage. The attachment of the rectus abdominis to the sixth costal cartilage is divided, the fibres of the pectoralis are divided and held aside, and the attachment of the intercostal muscles to both borders of the cartilage is separated.

The perichondrium is then separated all around. The costal cartilages are divided as need arises. The internal mammary vessels running obliquely across the space close to the sternum may require to be ligated and divided when the sixth costal cartilage is excised. After the fibres of the triangularis sterni and a layer of fat which indicates the line of pleural reflexion have been hooked aside, the pericardium is exposed, and the pleural sinus can be reached also if necessary. The pericardium is divided to reach a foreign body in the heart wall. The heart wall is repaired with fine catgut, care being taken not to include the endocardium. The pericardial sac is sutured with catgut and the chest closed in layers.

General Indications for Operation.

(1) Lacerated wound of the chest wall.
(2) Dirty or inflamed wounds of the chest wall.
(3) Wounds with comminution of rib or scapula.
(4) Open pneumothorax (sucking wounds).
(5) Retention of a large missile in the parietes or thorax.
(6) Wounds of the diaphragm.
(7) Infection of the pleural cavity.

Indications in Detail.

(1) Lacerated wounds should be excised as above described. With efficient technique, most of them will unite by first intention.

(2) Wounds which are soiled, which contain clothing or shell fragment, or which are surrounded by an area of inflammation, should be completely excised and carefully cleaned.

(3) Comminution of a rib calls for complete excision of the wound and careful removal of bone fragments. If this is not done the wound will suppurate for many weeks, and infection may spread to the pleura.

(4) Open pneumothoraces or "sucking wounds" are undoubtedly the most urgent of all chest cases. They should be closed at the earliest possible moment by skin suture in the ward. An anæsthetic is not required and would be dangerous if the patient is collapsed, as he usually is, on arrival at the clearing station. Closure of these wounds is an essential part of the treatment for recovery from shock. Later, when the patient's condition permits, further operative procedures can be performed as required.

(5) When a large shell fragment is retained either in the parietes or thorax, operation is demanded. In either case the foreign body is removed if accessible, and the chest closed. It is probably unwise to open the thorax to remove shell fragments if not more than ½ inch in diameter, unless it is clear that the missile itself is causing pain. Missiles within the chest probably do not cause pain, unless they lie within the pleural cavity, or in contact with the pleura. Bullets and shrapnel balls should not be followed into the chest, unless there is evidence of sepsis.

(6) Wounds of the diaphragm should be searched for and carefully sutured. The results of closure of these wounds are very satisfactory. The respiration at once becomes steady and is no longer forced.

(7) Demonstrated infection in a large wound or in the chest-fluid was considered a sure indication for operation. When the infection is found early, the wound may be closed after carefully cleaning. In any intra-thoracic operation it is probably wiser to close the chest, if only for a day, in order to permit the lung to expand, adhesions to form and the infection to become localized.

Time for Operation.

The best time for operation varies with the nature of the case, and it is quite impossible to lay down any hard-and-fast rule. The sooner the patient can be safely operated on the more hopeful is the prognosis. In many cases one can operate within six or eight hours after admission, in other cases an operation within the first twenty-four hours would involve unjustifiable risk.

Preliminary Treatment.

Few, if any, cases of penetrating chest wounds arrive at the clearing station fit for operation. As a rule the patient is exhausted by the journey and may be suffering also from pain, loss of blood or shock. Often breathing is painful, and pulse and respiration much accelerated, but the general condition good. These cases respond quickly to rest in bed in the most comfortable position, warmth, and morphine enough to relieve the pain. In a few hours they are fit for operation. Another group of cases was characterized by pallor, rapid feeble pulse, shallow respiration and clammy skin. These cases were undressed quickly, wrapped in warm blankets and surrounded with hot-water bottles. The foot of the bed was raised about ten inches, and morphine was used if there was pain or restlessness. Sometimes the heat was supplied by an apparatus intended for giving hot-air baths to patients with nephritis. Believing that rest is most essential for these patients, we never allowed them to be bathed, or made more than the most superficial examination until the patient had rallied.

When, on account of extreme weakness of the pulse, one would like to elevate the foot of the bed, but pulmonary congestion and dyspnœa contra-indicate it, the patient must be laid flat by way of compromise. When pulmonary congestion is prominent and the pulse fairly good, the patient should be propped up. The best position for the serious case deserves careful attention, because it may be an important factor in his recovery. Few drugs were used. Glucose and sodium bicarbonate, five per cent of each in water, was given by rectum by the drop method for cases of collapse from shock. Digitalin $\frac{1}{50}$ grain, strophanthin (B. and W.) $\frac{1}{250}$ grain was given intramuscularly when the pulse was weak and rapid from any other cause. Subsequent doses were ordered if indicated after two, four or eight hours. Although the pulse often improved soon after the administra-

tion of the drug, this may have been due to other causes. To promote rest by relieving pain and distress, morphine was given subcutaneously to nearly all cases on admission. For this purpose, $\frac{1}{6}$ grain was sufficient in nearly all cases, and therefore preferable to larger dosage. Excessive doses of morphine have a definitely depressing effect, which shows itself on the following day. Atropine was not used with the morphine by routine, except as a preliminary to operation. It was ordered with morphine both in preliminary and later treatment, when pulmonary œdema was manifested by wheezing and light frothy expectoration. Attacks of pulmonary œdema were frequent in our cases, both on admission and subsequently. They showed a tendency to recur at night. Morphine $\frac{1}{6}$ grain, and atropine $\frac{1}{120}$ to $\frac{1}{100}$ grain generally gave much relief, and sometimes the disappearance of the dyspnœa and wheezing following the subcutaneous administration of these drugs was striking. Atropine was not used for bronchitis, but was of apparent value when the sputum showed the presence of œdema in addition to bronchitis. The interesting pharmacological questions which arise in regard to the atropine cannot be discussed here, but we have reason to believe that the atropine had an important effect which could not have been obtained with morphine alone.

Blood transfusion was resorted to in a number of cases. It proved valuable and might, perhaps, have been used more often to advantage. On the other hand, it was several times observed that the blood had to be allowed to run in very slowly, and that no large amount of blood could be given without causing cardiac embarrassment. Whether this is usual in penetrating chest wounds we do not know, but considering the disturbance of pulmonary circulation caused by extensive lesions of lungs, it seems wise in this class of case to use transfusion cautiously. The transfusions were done by the indirect method, using the Kimpton tube, Vincent tube, or modified Carrel ampoule (No. 17). This method proved easy to apply and satisfactory in practice.

The importance of skin suture for open pneumothorax has been referred to above.

When the patient has recovered sufficiently, the physician and surgeon acting in collaboration should examine him thoroughly. If a radiological examination is needed, they should confer again when the resulting information is available. One cannot lay too much stress on the importance of screening, when skilfully done. Faulty examination with the screen may lead to the most disappointing results. The size and exact position of the missile should be determined before any attempt is made to remove it.

Post-operative Treatment.

The post-operative treatment of chest cases is important.

If a specimen of chest fluid has not already been obtained for examination in the laboratory, it is taken on the operating table. To avoid possible contamination, syringes and needle used for this purpose are sterilized

in the autoclave. Experience shows this precaution to be worth while. After operation, the patient is placed at first in the semi-recumbent, and later in the semi-sitting position, when his pulse is of good quality. When he is at all collapsed, hot-water bottles are used, sodium bicarbonate and glucose are administered by rectum from a Carrel ampoule, by the "continuous drop method." Intravenous saline, or five per cent sodium bicarbonate solution, is recommended by some surgeons, but we doubt if such infusions are more beneficial. Fluids are allowed *ad lib.* for the first twenty-four hours after operation, and eggs may be given in warm milk. Alcoholic drinks are withheld in the earlier stages after operation. At the end of forty-eight hours the chest should be needled, a specimen taken for examination, and aspiration performed if there are more than a few ounces of fluid in the chest. Smaller quantities can be removed by refilling the syringe several times. Should the chest fluid be found infected, or the fluid show a tendency to increase rapidly, the chest should be aspirated at intervals of from twenty-four to forty-eight hours. In such cases irrigation of the pleural cavity can be performed through the aspirating needle on the syphon principle. Aspiration, sometimes assisted by what may be called "aspiration-irrigation," may be the means of effecting a cure when the infection is not too severe.

When, however, fluid continues to accumulate, and the pulse and temperature remain elevated, one must resort to secondary drainage. If the operation wound is in a convenient place, preferably low in the posterior axillary line, a drainage tube can be readily introduced after removing a few stitches. The cavity can then be irrigated with warm saline or Dakin's solution, using a large amount once daily, or small quantities at frequent intervals. The former method is distinctly harmful in some cases, and apparently should be reserved for those in which the cavity is firmly walled off, and extensive collapse of the lung prevented by adhesions. When much air passes to and fro on removal of the dressing, showing pronounced mobility of the lung, it is well to irrigate through Carrel tubes, to keep them closed during the intervals and to place a large piece of jaconet in the dressing to prevent as far as possible the passage of air through it.

When, in spite of irrigation, a foul discharge continued from the cavity, and pyrexia persisted, in several instances we saw pulse and temperature fall to normal, after ½ ounce of "bipp" mixed with six ounces of liquid paraffin had been introduced into the chest. It seems to have real value in helping to clean up foul cavities. When using it, the effort should be made to bring the mixture in contact with all parts of the cavity, by turning the patient about. The excess is then allowed to run out. Poisoning was not observed, and is not likely to occur when there is a much thickened pleura and free drainage. In a few cases of draining empyema, we used polyvalent antistreptococcal serum in daily doses of thirty cubic centimetres with apparent benefit. For restlessness caused by

distress in the first days after operation, occasional doses of morphine $\frac{1}{6}$ grain, with or without atropine, according to circumstances, or of heroin $\frac{1}{6}$ grain were used. It is important at this stage that the patient should be quiet and at rest.

Anæsthetics.

Three methods of anæsthesia are in vogue :—

(1) Local anæsthesia.

(2) Chloroform and oxygen.

(3) Gas and oxygen.

A pre-operative narcotic is very helpful in all three forms, and when local anæsthesia is to be employed it is necessary.

(1) For "local" we used $\frac{1}{100}$ grain scopolamine, $\frac{1}{3}$ grain omnopon and $\frac{1}{100}$ grain atropine, given hypodermically one hour before operation. If the patient was not then drowsy another $\frac{1}{3}$ grain omnopon was used. Local anæsthesia has disadvantages. It takes from fifteen to twenty minutes to administer efficiently, and again to carry out intra-thoracic manipulation it is necessary to supplement it with gas and oxygen. The solution used contained one per cent novocain in normal saline, and to each ounce of this was added eight minims of adrenalin chloride (P.D.)

(2) Chloroform and oxygen given through a Shipway apparatus has been used extensively by Colonel Gask, and has given uniformly good results.

(3) Gas and oxygen has been used in thoracic surgery in America for several years. In this station we were fortunate enough to have the gas-oxygen apparatus known as the "monovalve," and there was ample opportunity to test its value in chest work. Having given "local" and chloroform and oxygen a fair trial, the conclusion was reached that gas and oxygen was the ideal anæsthetic for chest surgery. Desperate cases in which one would be afraid to employ the first two forms of anæsthesia will stand gas and oxygen surprisingly well. Gas and oxygen is but slightly toxic, cyanosis can be easily avoided, and it is possible to inflate the collapsed lung by oxygen pressure while the pleura is being sutured, and lastly, recovery from the anæsthetic takes place in a few minutes. This rapid recovery is believed to be an important factor in the success of this means of anæsthesia. Table VI gives data as regards pulse and blood-pressure during gas-oxygen anæsthesia.

A careful and experienced anæsthetist is required both for the administration of chloroform and oxygen, or for gas-oxygen in chest cases.

Results of Operations.

The general results, including those not operated on, are shown in Table I as regards casualty clearing station mortality. Of later results at the base, information at hand is incomplete.

TABLE VI.—GAS AND OXYGEN ADMINISTRATION. OBSERVATIONS ON THE PULSE AND BLOOD-PRESSURE.

Case 1.—September 12, 1917, Sergt. W.: Gunshot Wound Chest. Entrance only.

	Pulse	Blood-pressure
Before induction	144	69
Blood transfusion (750)	110	105
End of operation	124	110
One hour later	120	100
Four hours later	130	117

Died fifth day: Pericarditis. Bullet found in superficial femoral artery at autopsy. Perforation of thoracic aorta.

Case 2.—September 12, 1917, Pte. M.: Shrapnel Wound Chest, Left Leg.

	Pulse	Blood-pressure
Before induction	152	102
Pleura opened	146	125
Closure	156	135
Turned on side	84	115
End	104	96

Died two days later: Shock.

Case 3.—September 11, 1917: Shrapnel Wound Chest and Diaphragm. Entrance Wound only.

	Pulse	Blood-pressure
Before induction	140	107
Pleura opened	132	143
Diaphragm sutured	136	105
Lavage	136	105
Closure	140	84
One hour later	144	74

Died nine hours later: Shock. There were two large tears in diaphragm. A large missile was removed lying in vertebral recess. The spleen was much lacerated, and omentum was in pleural sinus.

Case 4.—September 18, 1917, Pte. H.: Shrapnel Wound Chest, Arms and Buttocks; Foreign Body from Pleura.

	Pulse	Blood-pressure
Before induction	104	105
Pleura opened	—	—
Pleura swabbed	140	140
Closure	160	120
Excision other wounds	150	110

Base, September 28, 1917.

Case 5.—September 15, 1917, Pte. S.: Shrapnel Wound Left Chest; large Foreign Body removed from Pleura.

	Pulse	Blood-pressure
Before induction	120	128
Pleura opened	160	170
Closure	144	100
End	130	100

Base, September 21, 1917.

Case 6.—September 7, 1917, Pte. V.: Gunshot Wound Chest, Extensive Entrance Wounds; Streptococcal Infection.

	Pulse	Blood-pressure
Before induction	114	135
Resection	120	130
Pleura opened	130	150
Lavage	130	130
Closure	124	135
One hour later	120	130
Four hours later	112	138

Base, September 24, 1917.

Case 7.—September 12, 1917, Pte. T.: Shrapnel Wound Chest, Extensive External Wounds—both "Sucking"—Left Arm.

	Pulse	Blood-pressure
Before induction	160	60
Blood transfusion (700)	128	88
Lavage	136	92
End of lavage	148	80
Excised wound arm	144	93
One hour later	144	96
Three hours later	160	80
Eight hours later	160	70

Died eleven hours later.

Note.—The above cases were all in a very serious condition when operated on.

TABLE I.– 297 CASES.

Results in General at Casualty Clearing Station.

	Sent to Base	Died at Casualty Clearing Station	Totals
Operated on	111 (79 per cent)*	30 (21 per cent)	141 (46 per cent)
Not operated on	134 (86 ,,)	22 (14 ,,)	156 (53 ,,)
Totals	245 (82 per cent)	52 (18 per cent)	297, total of all cases

* Two of these cases are known to have died from sepsis at the base.

In Table II the results of operation have been classified in three main groups, and in Table III A, B, C, these groups have been subdivided and further analysed. The cases which had parietal operations only, show a strikingly low mortality as compared with thoracotomies. Generally speaking they were the least severely injured cases. The primary drainage group of fifteen cases is too small a number on which to base definite conclusions, but its very high mortality as compared with the thoracotomy group may be significant, and certainly suggests that primary drainage is a pretty serious operation to perform early. This group, on the other hand, included most, if not all, of the heavily infected cases and some cases of open pneumothorax believed to be badly infected. Table III A is of interest especially to show the type of cases in which secondary drainage was required and its results. The group of secondary drainage totals only fifteen cases, the same number as that of primary drainage, and again, there are not enough cases to draw conclusions from. It may be worthy of note, however, in view of the present tendency to close all chests, if only for a short time, that the results for secondary were better than those for primary drainage. Secondary drainage was performed in twenty per cent of all the cases of thoracotomy.

TABLE II.—141 CASES.

Operative Results Grouped.

Type of operation	Number of Cases	Sent to Base	Died at Casualty Clearing Station	Stay at Casualt Clearing Station
(1) Parietal	50 (35 per cent)	48 (96 per cent)	2 (4 per cent)	2 to 4 days
(2) Thoracotomy, chest closed	76 (54 ,,)	57 (75 ,,)*	19 (25 ,,)	6 ,, 8 ,,
(3) Primary drainage..	15 (11 ,,)	6 (40 ,,)	9 (60 ,,)	21 days
Totals ..	141	111 (79 per cent)	30 (21 per cent)	—

* Two of these cases are known to have died from sepsis at the base.

TABLE III A.

ANALYSIS OF GROUP 2. 76 CASES.

Thoracotomy and Closure.

Sub-groups	Number of Cases	Sent to Base	Died at Casualty Clearing Station	Stay at Casualty Clearing Station	Secondary drainage at Casualty Clearing Station		
					Number of Cases	Sent to Base	Died at Casualty Clearing Station
Repair of parietes and removal of foreign body from chest wall	27	23 (85 per cent)	4 (15 per cent)	6 days	3	2	1
Removal of foreign body from lung or pleura	17	14 (82 per cent)*	3 (18 per cent)	6 ,,	7	5	2
Open pneumothorax, removal of foreign body	23	14 (61 per cent)*	9 (39 per cent)	6 ,,	5	1	4
Abdomino-thoracic; repair of diaphragm	9	6 (67 per cent)	3 (33 per cent)	8 ,,	—	—	—
Totals	76	57	19	6 to 8 days	15 (20 per cent)	8 (53 per cent)	7 (47 per cent)

* One of these cases is known to have died of sepsis at the Base.

TABLE III B.

ANALYSIS OF GROUP 3. 15 CASES.

Primary Drainage for Established Infection.

	Number of Cases	Sent to Base	Died at Casualty Clearing Station	Average stay at Casualty Clearing Station
Infected hæmothorax	7	4	3	21 days
Open pneumothorax	8	2	6	21 ,,
Totals	15	6 (40 per cent)	9 (60 per cent)	—

TABLE III C.

ANALYSIS OF OPEN PNEUMOTHORAX. 31 CASES.

	Number of Cases	Sent to Base	Died at Casualty Clearing Station	Average stay at Casualty Clearing Station
Closed and kept closed ..	18	13	5	6 days
Closed. Secondary drainage ..	5	1	4	6 ,,
Primary drainage	8	2	6	21 ,,
Totals	31	16 (51 per cent)	15 (48 per cent)	—

Table III C was prepared to show the results in all cases of open pneumothorax. It shows strikingly good results in the closed cases that did not subsequently develop infection, which, so far as a small series can, emphasizes the importance of early operation in these cases.

Stay at Casualty Clearing Station.

The average duration of stay at the casualty clearing station shown in Tables II and III indicates that most of the cases remained there long enough after operation to develop signs of intra-thoracic infection if they were going to do so.

It is our opinion, however, that many cases should have been kept longer at the casualty clearing station before being sent on a long journey. This would have been done had not pressure for beds necessitated early evacuation.

TABLE VII.

INFECTIONS CLASSIFIED. 30 CASES.

Nature	Recovered	Died
(1) Staphylococci	4	1
(2) Streptococci	5	8
(3) Gas bacillus	4	2
(4) Staphylococci and streptococci	—	3
(5) Streptococci and gas bacillus..	—	3

TABLE IV A.

OPERATED CASES TRACED TO THE BASE. 35 CASES.

Condition on Arrival at Casualty Clearing Station :—

Good	4	35
Fair	21	
Bad	10	

Missile :—

Shell fragment	29	35
Bullet	3	
Shrapnel ball	2	
Not known	1	

Nature of External Wound :—

Entrance only, closed	20	35
,, ,, open	2	
,, and exit, closed ..	10	
,, ,, one open ..	3	

Intra-thoracic Condition :—

Hæmothorax "uninfected" ..	26	35
,, "infected" ..	4	
Pneumothorax open	5	

Results :—

(1) Died at base from sepsis ..	2	35
(2) Secondary operation at Base	3	
(3) Uneventful convalescence ..	30	

Sent to England 33

Secondary Operations :—

Previously classed as "uninfected" hæmothorax..	2	3
,, ,, "infected" ,, ...	1	

Deaths at Base :—2.

One occurred in a case of secondary drainage for infected hæmothorax; the other in a case of open pneumothorax which had been closed.

TABLE IV B.

Type of operation	Number of Cases	Died at Base	Sent to England	Secondary operation at Base
(1) Parietal	8	1	7	—
(2) Thoracotomy ; chest closed..	19	—	19	2
(3) Primary drainage	4	—	4	—
(4) Secondary drainage	4	1	3	1
Totals	35	2	33	3

Results at Base.

Of special interest is a series of thirty-five operated cases, concerning which replies were received from the Base. Tables IV A and IV B give the main facts in regard to them. It will be noted that in eight cases, parietal treatment only was carried out, and that twenty-seven were thoracotomies. Reply postcards were sent down with nearly all cases, and as no further selection was practised, these twenty-seven thoracotomies should give a fair idea of the later history of the group which comprised ninety-one cases in all (see Table II, Groups 1 and 3).

Table IV A emphasizes the preponderance of wounds due to shell fragments as compared with bullets or shrapnel balls. Fragments of bombs and grenades were classified as shell fragments owing to their similarity. It also gives a rough indication of the condition of the patients on arrival at the casualty clearing station.

Results, Cases not operated on.

The mortality in cases not operated on at the casualty clearing station was fourteen per cent. Many of these patients were in such bad condition on arrival, that operative treatment seemed out of the question, either then or later. It is possible that transfusion followed by operation might have saved a few of them. Of the cases not operated on, few were traced to the base, and nothing can be said of their later history. There is at hand, however, unpublished data in two considerable series of cases, observed at the base between June and September, 1916, and between March and August, 1917.

The proportion of infections observed in the series was small. The weather was fine and warm, and the number of bullet wounds as compared with shell wounds was large. The low incidence of intra-thoracic infection may perhaps have been due to these causes.

In the second series serious infections were common, and deaths numerous, in spite of attempts at drainage. As regards weather and type of missile predominating in the spring of 1917, conditions were the opposite of those in 1916. The observations therefore tend to reinforce the general view that shell wounds lead more often to infection than do bullet wounds,

and that cold wet weather is unfavourable for chest cases. It is unfavourable to operated chest cases as well as to those not operated on, because of the frequency of severe bronchitis and pneumonia, so that operating at the casualty clearing station has rather to be curtailed than increased when the weather is cold and wet. Both series of cases observed at the base showed clearly that a good many do well without any operation at all. We should like to see more data published in regard to cases of this kind, lest enthusiasm for chest surgery be carried too far. Hæmothorax of itself, even when large, certainly is not an indication for thoracotomy.

Conclusions.

(1) Indications for operation can be clearly defined as in the text, but will be modified as future experience suggests.

(2) Open pneumothorax should be closed temporarily by skin suture at the earliest possible moment.

(3) The size and location of the missile as well as its nature should be accurately determined before operation.

(4) When thoracotomy is to be performed and the chest closed, the operation should be undertaken with the least possible delay, but with due regard to the general condition of the patient. The object is to remove the source before the infection becomes established.

(5) It seems probable that when known intra-thoracic infection has not become localized, the chest should be closed and drained later when necessary, and that primary drainage should be reserved, as a rule, for cavities of moderate size.

(6) The hæmolytic streptococcus is one of the most dangerous organisms. The gas bacillus, unless combined with other organisms, is less dangerous.

(7) Cases of thoracotomy, if possible, should remain at the casualty clearing station for two weeks or more, after operation.

(8) Gas and oxygen is the best general anæsthetic for chest cases.

(9) Careful management, both before and after operation, is important.

(10) The use of morphine, when indicated, is of great value both in the pre-operative and the post-operative periods.

(11) Close co-operation between surgeon, physician and radiologist adds materially to the success of the work.

SOME MUSINGS OF AN IDLE MAN.

By Colonel R. H. FIRTH.

I.

As so often happens at mess, we were discussing our seniors and betters one evening when, in respect of a certain person, someone said "Oh, he was nothing but a charlatan." As I could not sleep that night, I found myself thinking of the man who had been dubbed a charlatan, and as I knew him felt impelled to amuse myself with some reflections on the incident. Of course, we all pretend to despise what we call charlatans, yet in real life we must admit that a good charlatan more often than not gives us real pleasure, especially if we are able to see through him. The truth is, it is the business of such a person never to disappoint and it is rarely that he does disappoint. If we think of the converse man, the real genius, we appreciate that success to him is a mere by-product and that his sole aim is to do his work. All his genius is devoted to being a genius, and he has no energies to spare for behaving like one. With the charlatan, however, it is his business to behave as a genius and he often does it far better than the genius himself.

Whether we think of charlatan soldiers, poets, writers or musicians it is obvious that in each case the successful man must deceive himself. A musical genius may test his work to some extent on his landlady, relations or friends, and from them learn whether it is good or bad and what effect it may have on the outside world, but the charlatan must be his own critic, since he is audience as well as composer or author. It would seem that unless he have himself for gallery, he would never play at all; for to him the work itself is nothing but the effect everything. In putting it in that form, we mean that he tries to produce effects without causes, or the effect of genius without the genius itself. The odd thing about it all seems to be that such a man must produce these causeless effects upon himself before he can produce them upon others. In this way we can picture the complete and successful charlatan, as producing always causeless effects upon himself, losing all sense of cause and effect, and coming to live in a world of illusion, a world where the results are whatever he wishes them to be. It seems delightful, but the penalty is that he himself is subject ever to his own unreality, which unreality is the cause of his success and success increases it. But suppose some disaster befall, what then? The probability is that it will show him what he really is and so bring him salvation; but if not, then he gains the whole world at the price of his own soul.

The true life of the type of person of whom one is thinking begins when he comes before the world, because his art consists, not in producing sham works of genius, but in behaving as if they were real. To a large extent,

we onlookers are to blame, for we look for effects and the charlatan produces them; he conforms to our ideas of what he ought to be and we reward him with our applause. In this applause he takes so much delight that not a few of us get some pleasure in watching him. But it may be said that the man who gets the palm without the dust will not enjoy it. True, but the charlatan is in a class by himself, in that he spends life in enjoying the palm just because he has not earned it. If there is no more reality in life and no more significance than he finds in it, then all is well with the charlatan, and the conclusion is that it is as good to be a charlatan as to be a man of genius. If otherwise, then we must be so complete charlatans that we lose our own identity altogether in the various parts we play, with the result that at the end there is nothing left of us to condemn. In closing this topic, one recalls to mind the following refrain:

> Si vous lisez dans l'épitaphe
> Du magistrat Fabrice: "il fut homme de bien,"
> C'est une faute d'orthographe,
> Passant, lisez: "homme de rien."

II.

A little while ago, I went to see a senior officer in order to pay him a courtesy call and also to ask his advice. To my astonishment, I was greeted with scant courtesy, no sympathy, and came away without the advice I went to get. The incident annoyed me at the time, as the discourtesy shown was as unjustifiable as it was unexpected. Still, as I drove home, I could not help smiling to myself as I thought how it was one of those little happenings which bring home to us the truth of the old lines:

> "A manne by nothinge is so well bewrayed
> As by his manneres, in which plaine is shewne
> Of what degree and what race he is growne."

It was all a mere matter of manners and if "manneres makyth manne" it must not be forgotten that it is man who first makes manners. Before judgment can be formed as to whether an individual has manners or not, a standard of some kind must exist. And this standard, however it may vary in different countries, indicates some sort of ideal. The manners of people are not their laws, their customs nor their fashions, but rather an expression of their way of life and their deportment. Although the underlying principles of manners remain the same, history teaches us that the standard is ever changing, and what is fit and proper in one generation would be in bad taste the next. He, therefore, who would enjoy the advantages to be desired from intercourse with the best, must make a point of conducting himself in accordance with the prevailing mode.

It may be objected that the well-mannered person is too formal or

bound by set rules, but, just as order is the first law of Nature, so should self-discipline be the first rule of conduct. Without a code of some kind, society would be chaos. There is of course a golden mean in manners as in everything else, and dignity has its limits as well as ease. Further, what are usually referred to as good manners can hardly be said to be in any way natural to man. They rather may be considered as a check on natural impulse and disposition. They are a result of civilization and culture and to a certain extent, therefore, a sort of veneer. Although manners may to a large degree be a sham, still if they are of the best kind they are very agreeable. Each one of us knows the charm and calm about a well-bred and well-mannered man or woman that never fails to please, just as the reverse always ruffles and discomposes. For those holding a position of responsibility or authority the recognition of this fact is peculiarly imperative. I once was on intimate terms with a certain judge remarkable for his urbanity and good manners. Occasionally, I used to attend his court and note his way of performing unpleasant duties and pronouncing unfavourable decisions or sentences. His faculty of wrapping up and conveying unpalatable facts in kindly language and by courtly mien almost made one think it would be a pleasure to be tried and sentenced by him.

Just as the life of a nation is reflected in its literature, so is its individualism mirrored in its manners. The present day may be regarded as a period of transition in manners in all parts of the world. Nations have left or are leaving the old moorings, and forces are at work which are powerful factors in moulding modes of conduct. What the final outcome will be, few of us can form any idea; we can but hope that the old standards will not be jettisoned completely. It is easy to criticize and ever too difficult to conform oneself to an approved standard, be it of manners or morals; still, in our endeavour to avoid either extreme it may not be too pedantic to quote as a general guide to good manners the following words, the author of which I do not remember:

> "To thee be all men heroes; every race
> Noble; all women virgins; and every place
> A temple."

III.

Picking up the daily paper, one day, I was confronted with several columns of names of people awarded some new Order, while on another page was a paragraph stating that it had been decided to issue certain badges to persons who had served for so many months or done something or other. As I put the paper down, it flashed upon me that verily to-day is the day of badges. As I sat idling in the chair, certain thoughts came tumbling along to the effect that either, if we are not badged, some of us have other distinctions, or that those who are not badged must surely be among the undistinguished. These latter are they who have not the

delicate faculty required for attaining these distinctions, or they do not present their claims at the psychological moment, or perhaps worst of all they are unknown to the powers that be. This latter obviously is an important point.

Here indeed arose much food for thought. One may have done the State some service or one may have not. It does not matter much either way, for the chief thing is to know your influential man or, at least, be in a position to impress him with your merits. But this method of achieving distinction or exemption, as the case may be, does not commend itself to every one. In the matter of badges or other distinctions for war service, why not badge the man who has to pay a huge income tax? It is his mite towards the great expenditure and he is not the less patriotic because he has been compelled to give. The majority of us are patriots on compulsion; therefore, why not acknowledge this sacrifice officially? A sacrifice is a sacrifice, no matter by what means it is obtained. Either we are victimized or we offer up our goods as a voluntary sacrifice, and surely the victims are as worthy if not more worthy of recognition than the sacrificial devotees. So, why not an income tax badge?

Again, there are the men, women and children who have scraped in their "all" in order to buy a War Saving Certificate, a Bond, or to take up some War Loan. Does he, she or it not deserve a badge? It may be, their particular effort is not worthy of an Order, but a badge would do no harm and might develop much self-satisfaction with a corresponding incentive to go and do it again. Really, the thought grows and raises the vision of ardent patriots economizing so well and so persistently handing in their savings to the National Exchequer that their accumulated badges would outrival our best polychromatically be-ribboned warriors. We can go farther and logically conceive the people who have wholly or partly lost their incomes by the war as so many more sacrificial victims on the altar of patriotism and as such deem them worthy of recognition. For these poor souls, one pictures a gay and gaudy badge as a kind of set-off to the drabness of their lives since the war began.

Finally, we reach the question whether or not everybody who does anything should be badged. If that were so, then no man, woman or child would be able to raise the finger of scorn to his, her or its neighbour and say "You've been a slacker and a failure." At present we are badgers on rather a one-sided scale, but why should we not gain equilibrium and be a true nation of badgers? These thoughts have carried me far, but they clearly point a way to the removal of competition in patriotism and the rendering it possible for everyone to escape the opposite imputation. What more could be desired? for we cannot have it both ways. Either one must be distinguished or undistinguished, badged or unbadged. As a shy, undistinguished and unbadged man I feel disposed to vote for universal badging, and so be lost in the crowd.

IV.

I suppose our digestions were out of order; anyhow a small coterie of us had been exchanging views as to others, how they had got on and the opportunities and privileges they had had. It was all very amusing at the time, and not unflavoured with the taste of sour grapes, but later came the inevitable aftermath of quiet thought. It took the line of how difficult it is to appreciate the privileged at their true value. Even when they are obviously better than ourselves it is open to us to feel that, given their chances, we should have been better than they. There are many enlightened persons who depreciate the rich or well-born. They think that exceptional wealth must have a bad moral effect, and are pleased if a rich man shows himself a vulgarian, or a scion of some old family turns out a wastrel. To such people, the one is the effect of money and the other of breed and environment. If a rich man be generous, the temptation is to say that it is easy to give from superfluity. Similarly, if Crœsus has trouble, we remark that wealth has nothing to do with happiness. Yet, how many of us would fail to rejoice if chance gave us his fortune?

Much the same attitude crops up among the uneducated in respect of the educated, and it is not so very surprising, because the difference between an educated and an uneducated man is wider than that between the man with a hundred a year and the man with ten thousand. To analyse the position, we need to ask ourselves, What do we mean by "educated"? The best answer is that it means those who between 14 and 20 years of age have been able to give their time to books and athletics instead of to wage-earning. There we have it in a nutshell and the privilege is a democratic one. It makes no difference whether the boy has worked himself up the ladder from primary school to university or been helped up by money and environment to the desired mental position. In both cases, the individual is never again among the ignorant and not infrequently the desertion is resented by old associates. So much is this the case that it may be said that, except colour-bar, the sharpest of social differences is the difference of education. Whether education will be more respected when it becomes more general is difficult to predict. The ignorant have still the idea that it is the substitute for innate ability, but possibly as they get more of it they will realize that it is not. Of one thing we may be very sure, it is that however much we may increase the reasoning power, mother-wit can never be taught. That is a privilege which it is idle to envy and useless to depreciate.

This brings us back to that will-o'-the-wisp which our party of discontented ones tried to catch. That is, What is the secret of success in life? It would seem as if there are two kinds of success: the rare kind which comes to the man who can do what no one else can do, in other words, genius; and the commoner kind which comes to the man who has developed

ordinary qualities farther than most men. We can leave the geniuses alone, but in men who succeed greatly, whether we call them ordinary men or not, there is generally an urgency of desire not to be found in the great mass of mankind. They are the men who seem to know what they want to do, and from the first employ all their powers in doing it. By a a kind of instinct they plan their lives so that no effort of theirs is wasted, with the result that all their experiences and actions have a cumulative power. Here we find ourselves not far from the idea that genius consists in taking pains; but, if we say that the right kind of pains must be taken always, we leave to genius a good deal of its mystery. It is all very well for us to have talked about privileges and special opportunities, but after all the men we discussed, and at heart envied, had a power of developing ordinary qualities into an extraordinary efficiency for a particular purpose. In vain one thinks and seeks a name for it. It is not will or energy, because there clearly is in it a power of direction which these words do not imply. Character is too vague a word and used in too many different senses to explain anything; while, as for common sense, the very fact that it is common prevents it from being the cause of uncommon success. I leave it to the successful reader to settle this for himself and give the world a panacea wherewith to combat unsuccess.

V.

The preceding musing touches the fringe of another question, and that is, What attributes make men "great"? It is not easy to say, but of this we may be sure that there has never existed anyone who has been great in every respect. The essentials of greatness are a genius for a particular rôle and a mastery of the details of the position. Daring originality, a strength of mind to stand alone, and a disregard of current opinion are the necessities of those who would scale the heights. There have been scores of men who have been geniuses and yet blown their brains out. Weakness such as that is never the concomitant of real greatness. Of course, greatness is largely a matter of comparison, for it varies both in degree and kind. At some periods the necessary qualities are widely diffused, whilst at other times the general average ability is low. Further, much depends on locality. The first man in a village would be a mediocrity in a town and a nobody in a city. The really great ones of the earth are great everywhere, for the world is their theatre. Yet, after all, we need to remember that greatness is not an actuality, for it has no tangibility or reality; it is simply a relative term. He that is great to-day may be nobody to-morrow, because a greater than he may appear. This was the case with Philip of Macedon, who would have held a far higher place to-day had he not been eclipsed by his son Alexander. The greatness of Philip was local, whilst that of Alexander was universal.

Again, greatness varies in kind because every walk in life has its great

men. Just as there have been great kings, great rulers, great soldiers, great doctors, great statesmen, great lawyers, great poets, great musicians, great painters and sculptors, so there have been great cooks and great dressmakers. These two latter do not purchase their greatness by the destruction of their kind, like a Caesar or a Napoleon. Those men earned the epithet "great" at the cost of some two million of lives and the Kaiser may earn it some day by an even greater holocaust of men; but it is a big price to pay for a name.

It would be interesting, if only possible, to collect all the truly great men of the world and see how much room-space they would occupy. Probably, the whole of them could be placed in a room of ordinary dimensions, since men whose reputation will live through the ages appear but once in a century. Years have no power to dim the greatness of a Homer, a Shakespeare or a Milton; so with a Phidias, a Raphael or a Correggio. Though dead two thousand years ago, are not Plato, Socrates and Aristotle still teaching us? And do not the souls of a Handel, a Bach or a Beethoven still linger among us and stir our emotions and feelings? Or to turn to literature and history—a Bacon, a Gibbon, a Herodotus and a Thucydides live for us in our day, while a Demosthenes, a Cicero and a Plutarch each in their own spheres of oratory, exposition and biography dwell among us as great men.

Some one has said that some men are born great, some have greatness thrust upon them, while others achieve it for themselves. Whether this be true or not, we have to admit that some individuals must be first. Caesar said that he would rather be first man in a village than second in Rome, and Napoleon laid himself out to be not only the first man in France but the first man in Europe as well. To men of their type, greatness is a boundless circle, and their lives like meteors which consume themselves to enlighten the earth. They and others like them are they of whom it might be said, greatness is nothing unless it be lasting. For the greatness of the man who passes out of human ken is gone for ever.

The thought suggests itself here, Is the excessive development of a particular quality always at the expense of all others? In most cases we are tempted to see an atrophy on the one side which is proportionate to the exuberance on the other. The great general is rarely a great scholar, and the great poet is not usually a great statesman. It was said of Goldsmith that he wrote like an angel and talked like a slut. Some great men of course excel in more than one direction, but the failure of the greater number in other branches than their own is largely owing to shortness of time, and that he who would be truly "great" must look neither to the right nor to the left, but ever keep his goal in view. In so thinking, it is not suggested that every one can attain to greatness by untiring efforts, any more than every insect can become a butterfly or every bird an eagle. Obviously, there must be germs of greatness in every great man, for greatness must be latent before it can be developed, and even then

must have the opportunity to grow and have scope for its display. But the diamond is no less a diamond because still in the earth, nor the sun less an actuality because it cannot be seen or felt I recall Gray's lines in his "Elegy":—

> "Perhaps in this neglected spot is laid
> Some heart once pregnant with celestial fire;
> Hands, that the rod of Empire might have swayed,
> Or waked to ecstasy the living lyre."

But to such as these, may not the lack of opportunity to be great have been more than balanced by the chances of attaining happiness? I think so, for I doubt if a great man is ever happy as the word is understood ordinarily. I may be wrong, but to be happy indicates a certain degree of content, and such a condition is hardly possible to a really great mind, full of ambitions and ever confronted with fresh difficulties to be surmounted.

Then again, what about the selfishness, the faults and excesses which have marked the progress of so many of those whom the world has called "great"? True, it is not customary to judge an opera by a particular passage, a poem by a single verse or a picture by a particular part; but faults and excesses are aspects of so-called "greatness" which loom frequently in respect of many who have been called "great." Of these defects we would say they are but blots by which these great men show their humanity. These defects have had no part in the making of their greatness, but rather have prevented them from reaching that degree of excellence to which they would otherwise attain. Then, too, let us remember that the lives of the great, though crowded with incidents, have generally been short or ended tragically and sadly. Here, then, is consolation for us who are apt to complain because we cannot reach the topmost rung in the ladder of fame. Let us take heart, and if we cannot be among the great ones of the earth, we can, at all events, be great in those little things which go to make what is called life. The stars are not all of the first magnitude, yet each is doubtless doing that duty for which it is by Nature most fitted; similarly, do the individuals who go to make mankind differ from each other in the light which they shed and the greatness which they attain. For those of us who have failed to reach a conspicuous position, there is ever the consolation "the world knows nothing of its greatest men."

VI.

Among the periodicals which I take in and read regularly is one known as "Science Progress." The perusal of a recent number impels the thought, what will be the position of our remote descendants at the end of another two hundred years if knowledge continues to increase at the same rate as it has increased during the last seventy years? I tried to put myself back in the position of a man living in 1846, and realized how much the growth of knowledge had revolutionized our view of the world since

that date. As to the future, it is obvious that since our increase of knowledge is itself the result of a mental attitude which desires knowledge above all things, any future increase of knowledge will be only so long as that mental state continues in man. Some may question this, because they cannot conceive a civilization without a desire for knowledge, or because they assume that desire to be normal in civilized societies. Yet, history teaches us that among all the great societies of the past, only the Greeks and they only at their zenith, were consumed by a passion for knowledge, and even among them it was not without rivals.

Doubtless our present civilization represents the highest organization for the acquirement of knowledge which the world has ever seen, but our triumphs and enthusiasm in this particular cause will continue only so long as they satisfy the best minds. The desire for knowledge of material facts and things will persist only so long as it satisfies man's spirit, and we cannot assume that the appetite for scientific knowledge will grow always with what it feeds on. At times one is conscious of signs of a revolt and this revolt arises from the fact that our curiosity about the past has made us less complacent about the present. The more we learn about the mind and life of the past civilizations, the more we realize that they in some things were as good as we are and that our own energies are limited like theirs were. He will be a rash man who affirms that we excel the ancients either in the knowledge of ourselves or in the exercise of the purely not intellectual faculties. There are people who think that the more we know of the material world, the more we must know about everything; but that belief is not confirmed by experience. We have many theories about the relation of man to the universe, but none have been of use to us in the art of living. The present pursuit of material knowledge satisfies the surface curiosity of our minds, but our deeper and finer desires remain unsatisfied.

The more we look into it, the more we see that our modernism is characterized by a specialism in the pursuit of knowledge. Someone has compared our modern society to a hive of bees, each individual being absorbed in his task and losing all his individuality in the performance of it. This is a false simile, because men look before and after, and yearn for what is not. The more our desires are satisfied in one direction, the stronger they become in another, and our present-day stability of knowledge makes us all the more aware of our instability of faith and of ideas based on faith. Take morals for example, they are a working system but not based on any conception of the universe. In the same way, we fear our emotions, regard them as mere survivals and make no attempt to train them. The whole tendency is to starve all our faculties except those that are purely intellectual; yet, we have those faculties still with us and at times they assert themselves, and sooner or later they will divert our higher energies from a mere pursuit of knowledge to other ends, with the result that we shall be more concerned with being than with knowing.

Whether it will be a gain or a loss, I leave to the reader. For myself, I retain an open mind, but this much I do think; it is that, if it give a life more clear of purpose then it will be a gain. Our present-day difficulties are that we suffer from a deep and unwilling scepticism about the proper aims of life, and no advances in material knowledge satisfy the questions raised by this scepticism.

VII.

Riding along the bank of a certain canal in France one day, I came upon a group of men engaged in stoning a cat and some kittens which they were trying to drown. The incident aroused in me a forcibly expressed anger at the time and some serious thought later on. An interesting ethical argument presents itself as to why one is especially bound not to behave cruelly to animals. The doctrine of the rights of animals has been put forward by some humanitarians, but few philosophers are found to admit this doctrine. Pythagoras believed in the rights of animals because he believed in the transmigration of souls, and to him and to some orientals the killing of an animal was and is the same thing as killing a human being. On the other hand, Christian writers have been as careful to deny the rights of animals as the theory of transmigration itself. The teaching of the early Fathers of the Church was that the chief objection to cruelty to animals was lest anyone by exercising cruelty towards brutes may become cruel also towards men. Later writers are equally emphatic to explain that an animal as such has no rights. It is obvious that if we contend that animals have rights, we shall land ourselves into strange difficulties. We can ask ourselves, Have they a right to live? If they have, we must become vegetarians, and protest even against campaigns against the fly nuisance or for the extermination of mosquitoes. I once had charge of a lunatic who had become so sensitive to the horror of killing living creatures that he used to pick his steps carefully as he walked about for fear of treading on an insect. In daily life, we treat animals as though they do possess rights, for we feel that even the fly has the right not to have its wings pulled off for fun. But we cannot establish those rights philosophically. Many a time have I, and doubtless also has the reader, interfered with men ill-treating a dog or a horse, much in the same way as I revolted against the incident which was the starting-point of these musings. But, what was the cause of this revulsion? Doubtless the survival of some transcendental feeling which is stronger in us than all the reasonings of the philosophers. It is not a theory of the rights of animals, it is the growth of an almost religious sympathy in us which forbids us to be cruel to animals. It is our feeling for the pain endured by animals rather than any lofty concern for the honour of mankind that makes us hate to see bird, beast or insect tormented.

Our daily press gives us frequent evidence of our public attitude towards those who are cruel to animals, and it is encouraging to those

who believe in the progress of humanity. In these respects our progress has been appreciable, since we are more inclined than our forefathers to insist upon kindness to children and animals. But, even so, there are enough cruel people in the world and sufficient cruel practices still surviving in British sport to warrant the view that even now we human beings are nothing much to boast about and that there is still enough of the beast in us to keep us modest. The cat, for some reason or other, has always been the especial butt of human cruelty. Why this should be is difficult to say. Perhaps, humans have been specially cruel to cats from a feeling that it is only paying the cat out for its own cruelty to mice and birds. There is nothing more puzzling in Nature than the way in which a cat will play with its capture, and one is tempted to ask, what part does all this cruelty play in the economy of Nature? To watch a cat playing with a mouse often strains one's faith in the beneficence of the universe. The funny thing about it all is that, if one likes a cat, one forgives it easily even for its cruelty. We accept the scheme of Nature.

Possibly, our attitude to many kinds of so-called sportsmen has the same philosophic basis. Sport, such as coursing hares, has become to some people a second nature and we blame them for their conduct to the hare no more than we blame the cat for its conduct toward the mouse or bird. We recognize that it is the wild animal in us that delights in the pursuit of the fox or hare. Hunting and fighting are two of the greatest animal excitements known to man and doubtless the expression of the instinct inherited from our forebears who were driven to them by need. On the other hand, we do hate a cruel man quite as much as we sympathize with an ill-treated beast. We feel that the cruel man is a sinner, in that sins are only sins in so far as they can be translated into terms of what we call meanness and cruelty, which are themselves the ultimate shapes of selfishness. But the odd thing about it is that all mean or cruel people do not know they are mean or cruel, and the average man has a curious way of being indifferent to the ill-treatment of his own particular enemy. Truly, it is a funny world, but the redeeming feature is that the average man will not stand anyone being cruel to his dog or horse. In that, we hope there lies a justifiable cloak for many other sins. Perhaps for some of us it may be an asset when life's balance-sheet is struck.

VIII.

The occasion was a wintry day, and myself, feeling none too well, crouched over a stove in my draughty office hut at a certain Corps headquarters. As usual at such times, one's thoughts covered a wide field. The remembrance of them gives a strange jumble of retrospections, anticipations and castle-building. It is the fashion to deride the building of castles in the air. True, if carried too far the practice may amount almost to a vice, but if we divorce our dreamings too severely from our practical ambitions we rob ourselves of certain pleasurable moments and

valuable encouragements or incentives to action. The man who has never built an air-castle must be a dull fellow and curiously devoid of imagination or that hopeful confidence which tempts us on to fresh efforts. So long as we are trammelled by doubts and wonderings whether anything so beautiful could ever befall us, we must of necessity curb our fancies, turn sadly back from some flight into the realms of fantasy and be content to pass our hours in dull pragmatism. I confess to having enjoyed many a half-hour in castle-building, but, from a workaday point of view, it is necessary to keep the practical and the castle-building parts of us in separate compartments, and that is what, I fancy, the greater number of us do.

Closely akin to castle-building are anticipations. The pleasure of these is by some thought to be the greatest we can enjoy, but if this be so then life is as deceitful as a mirage and to the pleasure of the moment must be added the pleasure of expecting it. As a matter of fact, although our anticipations look to the future they are fed from the past, and if we have nothing in our experiences to go by we can expect nothing. If we expect more than we get of pleasure it is because memory also heightens a particular pleasure. In memory, a something takes the place of a past reality, and it is this vision of the past that we expect to be our actual experience in the future. In all our anticipations there is associated memory, and though anticipation and memory deal respectively with the future and the past they are themselves of the present. Of course there is an illusion somewhere, but probably of the moment itself. Shakespeare touches on this problem when he makes Hamlet say that there is nothing either good or bad but thinking makes it so. None of us are prepared to endorse this view except when thinking seems to make everything bad. If things seem good to us we unconsciously lose the *ego* in our sense of the goodness of things, and later on we forget the part that *ego* played and remember simply the pleasurable incident or thing. Much the same process goes on in respect of anticipation, as then we expect some pleasurable thing but do not expect the recurrence of our egotism. In other words, we train ourselves, by a suppression of the present, to see things as we see them when we remember or expect them. This analysis suggests then that by memory and anticipation we suppress or silence our mind at the moment and conceive a reality, much as still waters take a reflection. The reflections may have been broken or blurred, but we remember them as perfect and expect them to be perfect again. The deduction is, therefore, that only the past and future tell us what the present might be. Therein, for many of us, is the clue to not a few sad thoughts.

This brings us to that impossible condition of looking before and after and pining for what is not. Many of us have been tempted to say "If only one trivial thing had been different, all would have been so otherwise." The assertion or speculation is fallacious. The fallacy lies in the circumstance that the speculation raises the whole question of the freedom of the

will. If the will be not free, then for myself or anyone else having to live the past over again it would be a case of having to make knowingly all the old mistakes without the power to correct them. It is hard to conceive a worse condition. On the other hand, if the will is free then the old path of life can be trodden differently only at the sacrifice of personal identity. If in living his life over again, a man is to lose all the memory and consciousness of his former life, then for all practical purposes he is another and not the same man. Moreover, there is no certainty that as another man he would avoid any of the mistakes that he as the original man committed. On the other hand, if he retain his personal identity and say, "Here is where I made a mistake, so am going to act differently," then it follows that his personality must be changed in the process and his personal identity disappears. By this, one does not imply that a man's personality is exclusively the product of his experiences, but rather that it is not independent of them. In the personality of each of us there is an initial and individual element which is overlaid and developed gradually by the experiences and decisions of life, until in the end the only link between the original and acquired personality appears to be the persistent consciousness of personal identity. If that be lost, there is not the same but another man, and the experiences of the one cannot guide or correct the actions of the other. The truth is, we cannot separate experiences from personality and the speculation as to what might have been is just about as profitable as trying to square a circle. There is, therefore, nothing left for us but to make the best we can of the doubtfully consolatory conviction that "things are what they are, and their consequences will be what they will be." *Hinc illæ lachrymæ.*

IX.

From time to time, one has helped in censoring letters. True, the task is not a congenial one, since, for the most part, the letters areuninteresting and commonplace to a degree; still, occasionally one comes across a letter containing expressions, thoughts and perhaps a verse or two which are as suggestive as they are pathetic. These are letters written by men who have experienced those subtle changes in mentality which are some of the possible benefits produced by this war. One refers here to letters by men who, to paraphrase Kipling's words, "started as an average kid," but find themselves finishing as "a thinking man." The problem suggested is both strange and wonderful, also not without significance, for it is in the hands of these men, should they return, that the destiny of Britain will lie. No one could read some letters which I have seen without realizing that thoughts are coming to life in men's brains which were possibly there deep down long before this crisis stirred their half-unconscious but wholly inarticulate minds

I write as one who knows the British soldier well, having watched him in war, in work and in play, and reading some letters recently compels the thought that in these hasty scrawls stands revealed not only the soul of

the British soldier, but surely the very soul of Britain herself. I recall one letter, in particular, as being almost a sacred letter, for therein the unveiling was recorded in lines to be sent home only if the bar were crossed and it conveyed in death what the writer could never say in life. Another feature, which has often impressed me in reading some soldiers' letters, is the strong tie to home and country lying below the curious wordlessness of the average soldier. Before the war, many people talked as if the love of their homeland was dying out and that our island home had ceased to hold the hearts of her sons. No one can think that now. Both in words and by deeds one has seen with amazement what Britain meant to so many. The discovery of what the Motherland meant to thousands of Britons is only too eloquently marked by the graves in Gallipoli, France and Flanders, to say nothing of those under the waters of the North Sea, or in the desert sands of Mesopotamia, the Indian frontier and Africa. Each and all these obscure resting places send back the same message, "Tell England we lie here content."

Admittedly this musing is not free from sadness, but still it is compensated and refreshed by thoughts which come not only from reading the letters of obscure men but also from reading verses of unknown soldier poets. Take such lines as these, written by a Lance-Corporal :—

> "Within my heart I safely keep,
> England, what things are yours,
> Your clouds, and cloud-like flocks of sheep,
> That drift o'er windy moors."

To that man, the sight of No Man's Land and the desolation of a fair bit of country had opened his eyes as never before to the peace and natural beauty of his own country. Then again, the lines which my dead friend E. W. Tennant gave me in Laventie tell the same tale. In that shell-shattered town he wrote :—

> "I saw green banks of daffodil,
> Slim poplars in the breeze,
> Great tan-brown hares in gusty March
> A-coursing on the leas ;
> And meadows with their glittering streams and silver scurrying dace,
> Home—what a perfect place."

And it is home in the same way which fills the minds of many soldiers in their letters. These are the men who, compelled to live in some filthy, rat-infested trench when every shell must kill or spare, find their thoughts harking back to some dearly loved corner of Britain and can express both their fortitude and their longing in such words as Philip Johnson wrote :

> "I can't forget the lane that goes from Steyning to the Ring,
> In summer time, and on the Downs how larks and linnets sing,
> * * * * * *
> My God, I never knew till now that those days were so fair,
> And we assault in half an hour and—it's a silly thing,
> I can't forget the lane that goes from Steyning to the Ring."

Perhaps, after all, the love of home and country is no greater mystery than the tragedy of war ; and that the beauty of the one and the horror of

the other seems to bring home to some men that, unless they be willing to give their life, they shall never know the exaltation of living, Face to face with death, to many has been given a revelation of the joy and beauty of life. Before the War, to many life was hardly worth living and death hardly worth dying. Yet, when the great call came, to all who answered it, both life and death were transformed. I am reminded here of my one-time messmate, Julian Grenfell, for no man better voiced this thought of the changed outlook on life which the War aroused than he, in his lines :—

"The fighting man shall from the sun
Take warmth, and life from the glowing earth ;
Speed with the light-foot winds to run,
And with the trees to newer birth ;
And find, when fighting shall be done,
Great rest, and fullness after dearth."

It is curious to note how rarely one finds in the men's letters any introspective reference to the why and wherefore of the great tragedy, in which they themselves are playing large parts. The only instance of the kind that I have come across is presented by the following lines in the letter of a man in a signal company, attached to corps headquarters.

"'Tis not that I regret the life I lay
Upon the altar with a soldier's pride ;
But why the need? Is it that kings may play,
That I and all my ghastly comrades died?"

This musing has already gone farther than I intended, but I cannot close it without asking, Is there not some law of compensation which will make up for all this loss of young heroic life? It is hard to say, but surely the writing is on the wall and it reads: "All is worth while if it do but save Britain and make a better Britain." And who can tell us better what the Britain is that her sons are dying to save than Sergeant Coulson who wrote :—

"Mayhap I shall not walk again
Down Dorset way, down Devon way,
Nor pick a posy in a lane
Down Somerset and Sussex way.
But though my bones unshriven rot
In some far distant alien spot,
What soul I have shall rest from care,
To know that meadows still are fair
Down Dorset way, down Devon way."

And if to keep those meadows fair and safe, a life or lives be required, we know there are and have been many willing to pay the price and say, "they are very proud and glad to do this thing for England's sake." It is difficult not to grudge the price, but in the words of one of them who has faced and made the great sacrifice, we can say of each and all :—

"Our country in the storm of war
Has found him fit to fight and die for her,
We lift our heads in pride for evermore."

THE LATE APPEARANCE OF AGGLUTININS IN PARATYPHOID A FEVER.

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(*A Report to the Medical Research Committee.*)

(*Continued from p.* 152.)

The Late Appearance of Para A Agglutinins.

Previous work on the subject gives one the impression that not only are the agglutinins of para A bacillus produced in small amount but also that they disappear very early in convalescence. Thus Walker Hall [2] makes the statement: "General evidence seems to point to the fact that in the later weeks of paratyphoid fever the paratyphoid titre falls rapidly. This higher agglutination (i.e., than the inoculation agglutinins) must be read therefore in association with the early weeks of the disease." A perusal however of Hall's own records (Tables A and B) shows that the agglutinins for both para A and para B are present in relatively large amount from the fifth to the twelfth weeks, while their persistence, to judge from those tables, is more marked than his deductions would suggest. A study of the cases recorded in the present paper in relation to the time dating from the commencement of the pyrexia, at which there is the maximum production of para A agglutinins is summarized as follows:—

TABLE III.—Analysis of the Thirty-three Cases in reference to the Date of Appearance of the Highest Para A Titre.

	Series inoculated with T.A.B.	Series inoculated with T.V.
First three weeks	Nil	Nil
Fourth and fifth weeks	6	5
Sixth and seventh weeks	8	5
Eighth week onwards	5	4

It is seen that the highest para A titre in the great majority of the cases in both the T.A.B. and T.V. series occurs between the fourth to the seventh weeks inclusive. Dreyer [1] has called attention to the fact that in his series of cases the maximum agglutination is reached about the twentieth day, although he insists that in para A cases the titre is often very low. In the present records, at this stage of the disease, the agglutinins are usually present; but when the end titre is considered and when the cases are followed up into the later weeks of convalescence a much higher agglutination titre is found to be recorded. Thus in none of the present series of cases is the maximum agglutination reached earlier than the fourth week, while from the fourth to the seventh week inclusive the titre is maintained at a high level. In the several records of individual

cases of paratyphoid infections quoted in their paper by Martin and Upjohn [4], an equally high agglutination in the fourth and fifth weeks of the fever is seen to have been obtained. These observations appear to have an important practical bearing. There are doubtless many cases of slight and transient fever, due to a para A infection, in which an agglutination test within the first fifteen to twenty days has proved negative, even in low dilutions of the serum, and which owing to the indefinite clinical manifestations have been diagnosed "non-enteric." In this way a certain proportion of potential paratyphoid carriers may be missed, through reliance being placed on laboratory examinations confined to the period of pyrexia, or early convalescence, while serological investigations, if continued into later convalescence, may prove that a paratyphoid infection is present. In this connexion, the present series of cases affords several good illustrations. One of the most marked examples is that of Case 14, Table II. Here we have a clinically mild paratyphoid infection in an uninoculated subject—temperature of ten days' duration with concomitant symptoms, rose spots, etc. Agglutination reactions on the third and fourteenth days were quite negative to *B. paratyphosus* A, the figures for *B. typhosus* being ten and five units respectively. The agglutination test was repeated on the twenty-first day, when para A agglutinins were present, viz., thirty units, and on five subsequent examinations up to the eleventh week from the commencement of the illness the agglutinins for para A remained persistently present. The same delayed appearance of the specific agglutinins is seen in cases of long continued fever. For example, Case 4, Table I, is a continued fever of twenty-six days' duration which was clinically extremely suggestive of an infection of the enteric group. Examinations on the second and fourth week were completely negative to para A agglutinins, and it was only in the light of previous experience that we were led to do a later examination, when the para A titre was found to equal 140 agglutinin units and a fortnight afterwards 325 units. The organism in this case was not isolated from either blood culture or fæces. Case 17, Table I, is another case in which no para A agglutinins were obtained until the fifth week. This patient was very ill until the sixth week, for after a typical sixteen days' fever there followed a continuously intermittent temperature from the twenty-fourth to the forty-fifth day, para A being isolated from the fæces during this relapse. Such cases as these show the futility of basing any laboratory opinion on single and casual agglutination reactions in persons inoculated with typhoid or T.A.B. vaccine, while even in a series of tests the fallacy involved in a negative report unless correlated with the clinical course of the affection is sufficiently apparent.

Moreover from a statistical point of view there is the obvious error of basing comparative figures on the incidence of typhoid and paratyphoid fevers on agglutination tests done during pyrexia or early convalescence where blood cultures or bacteriological examinations of the excreta have

either been negative or neglected. This is partially due to the increase in *B. typhosus* agglutinins which precedes the production of those of para A. In the present series of cases recorded in Tables I and II this group reaction for *B. typhosus* has been a remarkably constant feature, and further demonstrates how unsatisfactory it is to base a diagnosis of the type of enteric infection on agglutination reactions within four weeks of the commencement of pyrexia. Thus to take Case 19, Table I, the agglutinins for *B. typhosus* on the twelfth day of illness equalled 222 units—a relatively high figure—while those for para A were fourteen units. In the fourth week *B. typhosus* had fallen to 22 units, while para A had increased to 57 units, and to 288 units by the fifth week. Curves showing a similar variation may be seen in Charts A, B, and E, which are taken from Cases 1, 2, and 17 of Table I. The possibility of this statistical fallacy has repeatedly revealed itself, for quite a number of cases admitted as "typhoid fever"—the diagnosis having been based on agglutination tests carried out during the acute stage in Mesopotamia—have been found on later examination to be really cases of paratyphoid A fever.

The Extent of Production of Para A Agglutinins.

The extent of the production of Para A agglutinins is usually considered to be slight. Although it is true that the low dilutions of the serum are a considerable aid to their detection during the earlier stages of the fever, yet the neglect of the study of their variation later in convalescence has led to an erroneous idea as to their amount. Thus Firth [7] says, "Even under the most favourable circumstances the patient's serum rarely gives a positive reaction for the A variety in higher dilution than 1 in 100. Often *B. typhosus* agglutinins are marked while Para A is not agglutinated by 1 in 10 dilutions of the serum." A perusal of the present records and charts appears to show that Para A agglutinins are produced in many of the cases in relatively large amount, especially at some period between the fourth to the seventh week. Although there is a comparatively feeble production of Para A agglutinins in the early stages of the fever, yet frequently at a later period the agglutinins are quite as strong as those agglutinins of *B. typhosus* which occur in the early stage of paratyphoid fever, or in typhoid fever itself. Hence such statements as "the variable and comparatively feeble production of agglutinins in paratyphoid fever, especially Para A" [7] seem to require considerable modification.

In view of the fact that previous work on the subject has been carried out on patients who had either never been inoculated or who had received simple typhoid vaccine, it was thought that the triple vaccine might in some way contribute to this delayed but stronger production of Para A agglutinins. Support is given to this suggestion by the relative diminution of inoculation agglutinins which is found to occur in a certain number of the cases, followed by the preliminary rise of *B. typhosus* agglutinins previous to Para A asserting itself. This initial diminution in agglutinins

may be analogous to the "negative phase" phenomenon. Our ignorance of the processes on which agglutination depends prevents any dogmatic statements, but our observations on the response of inoculation and infection agglutinins suggest that inoculation may play an important rôle in this delayed appearance of Para A agglutinins. A consideration of the average time when the agglutination titre is highest in patients inoculated with T.V. and T.A.B. respectively does not show any difference either in the date of appearance or amount of agglutinins produced. The average period for the T.A.B. series is 6·4 weeks, and for the T.V. series 6·5 weeks. A comparison between the mass agglutinins during (1) the first four weeks of the illness and (2) the period from the fourth week onwards of the cases in Tables I and II is so untrustworthy that no deductions can be made with any confidence. Apart from the fact that it has not been possible to make agglutination tests with any regularity during the first three weeks, and therefore no average can be struck for the mass agglutinins during that period, there is the fallacy of attempting to draw conclusions from a comparison of those two intervals, since Para A agglutinins reach their maximum production from the fourth to the seventh week, and the mass figures will depend on whether the rising Para A titre and the preliminary increase in *B. typhosus* agglutinins fall immediately before or after the commencement of the fourth week.

The Question of the Relative Diminution or Absence of the Inoculation Agglutinins during Pyrexia.

The relative diminution of the inoculation agglutinins during pyrexia in a number of the present series of cases has already been mentioned. This observation has an additional interest in its bearing on Tidy's [8] much discussed assertion that the inoculation agglutinins of *B. typhosus* are markedly reduced or entirely disappear in the early stage of febrile conditions, and that a positive agglutination test to *B. typhosus* after the fifth day of fever has the same value in an inoculated as in an uninoculated person. An analysis of the cases which had been inoculated with T.A.B. vaccine shows that agglutination reactions during the first and second weeks of the pyrexia have been obtained in twelve cases. Five of these show complete absence of all agglutinins during the pyrexia. Three others show a marked diminution, while of the remaining four the figures are either doubtful or suggest no diminution. The average interval that has elapsed since T.A.B. inoculation in the case of those showing complete absence of agglutinins is twenty weeks, as compared with an average of twenty-three weeks for the others. These figures certainly suggest that that there is a considerable reduction and occasional disappearance of the inoculation agglutinins in a proportion of the cases, small though the numbers be. It is to be noted that this reduction is immediately followed by an increase, usually considerable, in the *B. typhosus* agglutinins as a

result of the stimulation produced by the paratyphoid infection. An analogous phenomenon, we find, is mentioned by Ainley Walker [9] as occurring in experimental work in animals. If an animal which has been immunized some weeks or months before with a particular micro-organism be inoculated with a non-lethal dose of a vaccine prepared from some other micro-organism, its agglutination titre for the first organism exhibits a new rapid rise of greater or less extent and pursues a curve similar to the ordinary inoculation curve. "Immediately upon the second inoculation there may occur in a proportion of cases a moderate and purely temporary fall in titre probably somewhat similar in character to the negative phase of the opsonic index and passing off within a few days to be followed by the rapid rise just mentioned." Walker further notes that if a longer period has elapsed, e.g., five months before heterologous inoculation is given, there may be no change of any kind in the inoculation titre, though if any change does take place its main feature is a rise in titre.

Apart from this possible interaction between the inoculation and the Para A infection agglutinins, nothing in the clinical condition can be suggested as accounting for this irregular disappearance or reduction of agglutinins. No evidence from any of the records of the present investigation, however, can be obtained to support Tidy's assertion that a positive agglutination reaction to *B. typhosus* after the fifth day of pyrexia has the same value in an inoculated as in an uninoculated subject; moreover, numerous febrile cases of non-enteric origin showed no diminution of the inoculation agglutinins resulting from previous T.A.B. inoculation in tests carried out during the acute stage as compared with the results obtained during the afebrile period; while a study of the agglutination reactions in a series of malarial patients, who had previously had T.A.B. vaccine, revealed no difference between the agglutination titre of the serum taken during the febrile paroxysm, and of that obtained during the apyrexia of convalescence. It is to be noted that in Table I no reduction in the agglutinin values is apparent after the second week. Indeed only the cases in which investigations were made during the first two weeks have been considered in the present connexion. Hence it may have been that in some of the previous work on this subject, a diminution or absence of agglutinins has been missed through the serological test not having been carried out at a sufficiently early stage of the affection.

The Agglutination Curve of B. Typhosus in Paratyphoid Infections.

Little need be said regarding the rise in the *B. typhosus* agglutinin curve which precedes or is synchronous with the increase in the production of Para A agglutinins in most of the present cases. This was first pointed out in 1911 by Grattan and Wood [3], and has been confirmed by subsequent workers. Its chief interest appears to be its relation to the reduction in the agglutinin content which immediately precedes the rise, and to the

possible light sheds on the interaction between inoculation and infection agglutinins. But what is also to be noted from the protocols is the irregularity in the agglutinin curve of *B. typhosus* which appears to be largely due to a second rise which occurs very often subsequent to the agglutinin titre for Para A reaching a low level and which tends to give the whole curve a "saddle-back" appearance. This rebound is difficult of explanation, although all the evidence points to the inoculation agglutinins being the factor thus influencing the curve. In this connexion attention may again be drawn to the first appearance of para B agglutinins very late in convalescence (twelfth to sixteenth weeks) in a number of the cases which had been inoculated with T.A.B. and which had never shown any trace of those agglutinins at an earlier period of their investigation.

It has, of course, to be remembered that certain of these variations are "mean variations" in that they represent the next dilution above or below, and no attention need be paid to those "one tube differences." Yet some of the alterations in agglutinin content are most perplexing when the behaviour of the curve is being studied. In several of the cases in which the diagnosis of para A has been confirmed by isolation of the organism, sudden drops in the amount of para A agglutinins occur, to be followed by an equally sudden and unexpected rise for which no explanation can be assigned from a consideration of either temperature chart or clinical condition. For example, in the case of No. 5, Table I, in which para A was isolated from the fæces, the figures for para A in standard agglutinin units are :—

Week :	7th	9th	11th	12th	13th	15th
Paratyphoid A agglutinins ..	510 ..	510 ..	145 ..	250 ..	580 ..	58

The history and clinical condition of these cases were always carefully considered, while the occurrence of all such divergences led to the repetition and careful controlling of the agglutination tests. Incidentally it may be mentioned that in connexion with an investigation at present in progress we have repeatedly examined the agglutination reactions of forty of the men of our own personnel, the date of whose inoculation with T.A.B. vaccine was accurately known. As many as five tests in certain instances have been carried out over a period of nine months. A gradual diminution in the amount of the inoculation agglutinins in any individual case was perfectly apparent, but the very marked differences and striking contrasts between the figures obtained for men inoculated at the same time, and from the same bottle of vaccine, has convinced us that the average figure for the agglutinins obtained from such divergent results cannot be taken as representing the probable agglutination titre of any individual's serum at any given period after inoculation.

The Relation of Pyrexia and of Relapses to the Production of Agglutinins.

The elucidation of some of the irregularities of the agglutinin curves has been attempted by a study of the relation of the end of the fever and of the occurrence of relapses to the agglutinin content. A consideration

of the records with regard to the relation between the pyrexial period and the date of the maximum agglutination titre of the serum shows that the period varies from a few days to seven weeks, the average being approximately three weeks. The relation, however, is more evident in cases of long-continued pyrexia. In these instances the para A agglutinins are correspondingly late in their appearance and serological diagnosis is for a considerable period indefinite in spite of a series of agglutination tests. Of this, Case 17, Table I, is probably the best example. The patient ran a continuous temperature for over six weeks. Examination during the first and third weeks gave a figure of 110 and 220 units for *B. typhosus* agglutinins, while those for para A and para B were absent. The patient had been inoculated with T.A.B. vaccine forty weeks before. By the fifth week the titre for para A had reached a considerable height, viz., 285 units, and this increased until the record for the eleventh week was 500 units, after which there was a gradual fall, 37 being the figure for the fifteenth week. It may be noted that in this case the para A bacillus was obtained from the fæces during convalescence.

Relapses occurred during the convalescence of five of the cases, viz., Nos. 3, 5, 6, 11, of Table I, and No. 1 of Table II. The exact periods of the return of pyrexia in these cases have been compared with the date of the maximum production of agglutinins as well as with the agglutinin curves as a whole. No connexion can be detected between the relapse and either an increase or decrease in agglutinins. Indeed, in Case 1 of Table II, the relapse is synchronous with the highest figure recorded for para A, as it occurs from the thirty-second to the thirty-ninth day, while the maximum agglutinin production takes place during the fifth and sixth weeks. However, if one considers the usually accepted theory of the etiology of relapses that they are due to an infection with a different but closely allied organism, then, unless there be a production of co-agglutinins, no inter-relation between the pyrexial relapse and the agglutinin curve would be expected to exist.

It is with pleasure that I express my thanks to Lieutenant-Colonel A. W. Sheen, R.A.M.C., Officer Commanding —— General Hospital, for the facilities placed at my disposal for the carrying out of this investigation, as also for free access to the clinical records of the hospital. To Pte. N. Greenwood, R.A.M.C., I am greatly indebted for his assistance in the carrying out of the tests, for his help in the compilation of the records, and for his enthusiastic interest in the progress of the work.

Conclusions.

(1) The present study of the behaviour of the agglutination curve is based on a series of thirty-three acute cases, mostly paratyphoid A fevers, from fourteen of which the infective organism has been isolated either by means of blood culture or from the fæces. The agglutination reactions have been carried out at intervals from the first to the twentieth week

dating from the commencement of the fever, while in every instance the agglutinin titre has been worked out to its end-point.

(2) The agglutinins for *B. paratyphosus* A are in a proportion of cases of paratyphoid A fever very late in their appearance. In the present series of thirty-three cases the highest agglutinin-titre has never been recorded before the fourth week from the commencement of pyrexia, while in twenty-two of the cases the maximum agglutinin content did not occur before the sixth week.

(3) Although the presence of para A agglutinins may occasionally be revealed by agglutination tests carried out in low dilutions of the sera, yet this is by no means constant, for those agglutinins appear to be sometimes altogether absent until a comparatively late period of convalescence when they may be found present in large amount. It would appear as if the reason why the maximum agglutination titre for para A has always been considered to be relatively low, is that its estimation has not been followed into convalescence.

(4) A certain proportion of potential paratyphoid carriers may thus be missed through reliance being placed on negative laboratory tests confined to the period of pyrexia or early convalescence, whereas serological investigation, if continued into later convalescence, may prove the presence of a paratyphoid infection.

(5) In two-thirds of the present cases in which agglutination tests have been carried out during the first and second weeks of the pyrexia, a marked diminution and occasional disappearance of the inoculation agglutinins has been found to occur. In cases of malaria and other acute non-enteric febrile conditions no such diminution of the agglutinins resulting from previous T.V. or T.A.B. inoculation has been detected when compared with the agglutination reactions obtained during the afebrile state.

(6) A marked ascent in the *B. typhosus* agglutination curve usually precedes or is synchronous with the appearance or increased production of para A agglutinins. This group reaction for *B. typhosus* has been a remarkably constant feature in both the T.V. and T.A.B. series of cases.

(7) No relation is to be detected either between the occurrence of relapses and an alteration in the agglutination curve or between the end of the pyrexia and the date of record of the maximum agglutinin content.

(8) The increase in *B. typhosus* agglutinins which seems invariably to precede the ascent in the para A curve, coupled with the frequent late appearance of para A agglutinins, shows the futility of basing any statistics on the relative incidence of typhoid and paratyphoid fevers diagnosed from single and casual agglutination tests carried out during either pyrexia or early convalescence in cases where blood cultures have either proved negative or been neglected. This conclusion applies to persons inoculated either with typhoid or triple vaccine; while even after the performance of a series of agglutination reactions there may be a fallacy involved in a negative report unless correlated with the clinical course of the infection.

(9) These observations suggest that in suspected cases of fever of the "enterica" group in subjects inoculated with T.A.B. vaccine, the value of the agglutination reaction as an aid to the rapid and accurate diagnosis of the specific infective organism is for practical purposes nil. If, however, it be possible to plot out the agglutination curve obtained by the performance of a series of tests repeated at short and regular intervals and continued well into convalescence the scientific interest of the reaction may be considerable in the study of the inter-relationship of inoculation and infection agglutinins, and of the processes on which the agglutination phenomenon depends.

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DYSENTERY—A CLINICAL STUDY.

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The following report is based upon the records of some 600 cases which were admitted into the dysentery wards of the General Hospital at Alexandria, between May, 1916, and February, 1917, and were under the care of the writers.

The cases were of very different character; some were admitted into hospital on their arrival from England acutely ill. Some, also acutely ill, came from local camps on the Western Front; while others were admitted from Salonica, India, Mesopotamia, or other hospitals in Egypt, more or less convalescent, suffering from acute relapses, or with chronic dysentery.

A certain number of patients were suffering from their first attack of dysentery. Others had suffered previously, and in a few the disease was of old standing, and must have been present for many months. The majority were otherwise healthy, but a minority were infected as well with malaria and paratyphoid fever; or had previously had attacks of these diseases, or sunstroke, sandfly fever, etc.; while in another group visceral disease of varying kind co-existed.

The cases were thus in no way comparable and we have in consequence laid little stress upon statistics. We may, however, state that entamœbæ were detected in the stools in more than 58 cases, a dysentery bacillus in 132 cases, and lamblia in 50 cases.

One is apt to forget that dysentery—the bloody flux—is a symptom of many diseases rather than a disease in itself, although at times epidemics of dysentery of uniform origin may occur. The type of the infection may, however, vary somewhat suddenly even in the same place. At Cape Helles for instance, amœbic dysentery was rife during July, August, September and October; while at Suvla Bay the main cause was bacterial (Captain W. Campbell). The interchange which occurred among the troops on the Peninsula, however, led to cross infections, and before the evacuation the cases in either place might be bacterial or protozoal; or a double infection might be present.

The movement of troops in this world war is so extensive that diseases indigenous to one place may be readily imported into another. So that in medicine as with arms all *ante bellum* standards have been upset and war conditions necessitate an avoidance of *a priori* theories. Colonel Sandwith,

for instance, tells us that it has been anticipated that the dysentery in Alexandria in the autumn would be chiefly protozoal whereas it has been mainly bacterial. Captain Lumb tells us that while the dysentery in East Africa prior to the war was wholly amœbic, the bacillary affection has been frequently seen there since the arrival of the Indian troops in the autumn of 1914. One of us had a patient under his care in the autumn of 1914 who came into hospital from the trenches on the Aisne, suffering from amœbic dysentery; and cases have been recorded where it has occurred in England in men who had never been away from home. The persistence and the latency of protozoal infections is responsible for a group of cases where an infection acquired in one country shows evidence of its existence when the carrier has reached the other side of the globe. The "Aisne" patient, for example, had had an attack of dysentery at Lahore eighteen months previously, and the infection had probably never been exterminated although all the symptoms remained in abeyance. Comparable histories are, of course, well known to occur in such diseases as malaria and syphilis.

This point cannot be too strongly emphasized as successful treatment of dysentery can only be ensured by an accurate diagnosis of its cause in the individual case. This can rarely be made in the wards. Laboratory findings are of great value, but pitfalls also exist in the laboratory, and its negative reports are of little value. The history of the illness, previous illnesses, and the itinerary of the patient are probably of as great practical importance; but all these factors, the history, the symptoms, and the laboratory reports, must be carefully correlated to ensure a correct solution. Even then one is often in doubt, and empirical treatment, with all its disadvantages, has to be instituted.

Amœbic Dysentery.

The protean character of the symptoms of amœbiasis of the intestine is well known, but is not perhaps sufficiently recognized. A very large percentage of the population where amœbic infections are endemic are carriers, with presumably a small local lesion in some part of the bowel so trivial in its degree that no evidence of its presence exists during life. Captain Dunne tells us that he saw several such cases (from the Peninsula) on the post-mortem table during 1915, the patients having succumbed to gunshot wounds. Strong quotes some statistics, and others are available from the recent literature. Strong and Musgrove in the Philippines found amœbæ in the stools of healthy individuals in four per cent. Musgrove found them in 101 of 300 prisoners in Manila, though only 61 were suffering from dysentery. Craig found them in 65 of 200 cases. Wenyon and O'Connor (Alexandria) found them in 5·3 per cent of the healthy troops, in 1·8 per cent of the prisoners in Gabbari Military Prison, and in 13·7 per cent of the Egyptian civil prisoners in Hadra. The incidence

of the infection is very considerable, too, among men who are convalescent from an attack of dysentery. Walker Hall, Adam, and Savage found them in 9·08 per cent, and Wenyon and O'Connor in 10·8 per cent of convalescent patients on their arrival in England. The incidence is not confined to cases of dysentery, but also obtains in enterica convalescents. Walker Hall's figures show 10·06 per cent amœbic carriers among this group.

At one end of the chain lies the carrier with no symptoms of intestinal disturbance; at the other end the patient with acute dysentery. The intervening links are represented by cases presenting an infinite variety of symptoms. The difference depends upon several factors, the site and the degree of the lesions, and the presence of associated bacterial infection.

Tenesmus, for instance, depends upon the involvement of the lower part of the large bowel, and is absent when this is not involved. Diarrhœa is mainly due to intestinal catarrh of very varied bacterial origin. The presence of mucus in the stools predicates inflammation of intact, i.e., undestroyed mucous membrane. Blood is present if ulceration is progressive, or catarrh severe. An uncomplicated ulceration of the cæcum and ascending colon presents very different symptoms from those of widespread involvement of the colon generally, with some associated catarrh.

The whole series may be seen in the post-mortem room: the small uninflamed ulcer; the ulceration surrounded by acute catarrh; and the gut almost wholly devoid of mucous membrane, and necessarily incapable of secreting any appreciable amount of catarrhal products.

We are becoming somewhat sceptical as to the existence of pure acute amœbic dysentery, i.e., amœbiasis unassociated with bacterial infection. We have seen several such cases where the dysenteric symptoms subsided under general treatment before the entamœbæ were detected in the stools, and appropriate treatment instituted. And everyone knows that amœbiasis may exist without any evidence of the gastro-intestinal disturbance, and may not be recognized until an hepatic abscess or the rupture of an ulcer occasions notable distress. In one of our cases dysenteric symptoms were absent though death was due to the rupture of an amœbic ulcer. In this case the patient was admitted from Mesopotamia with a diagnosis of malaria, and after ten days' residence was sent to a convalescent hospital. A fortnight later fever recurred and he was admitted again to the wards on September 9, 1916. He was then seriously ill with a high temperature which frequently reached 105° F. *Bacillus paratyphosus* A was isolated from the blood, and the clinical symptoms were those of enterica. There was little or no diarrhœa until the end of September, when he became dull, lethargic, and semi-comatose, and incontinence of fæces ensued. A little mucus was now occasionally present in the stools, but these never suggested the presence of dysentery, and entamœbæ were not detected at the single examination that was practised. On October 13, 1916, signs of peritonitis made their appearance, but his general condition negatived operative

measures. He died on October 17, 1916. Post-mortem examination revealed widespread amœbic ulceration of the large bowel.

The post-mortem findings in this case were unexpected as the existence of amœbic dysentery was not suspected during life in view of the character of the general symptoms and the positive blood culture. There was never any blood in the stools, and mucus was only present during the terminal stages of the illness, and never in large amount.

In many of our cases the history was one of diarrhœa, or alternating diarrhœa and constipation following dysentery, rather than of chronic dysentery. A medical man, for instance, had a mild attack of dysentery at Cape Helles, in November, 1915, which did not necessitate hospital treatment; diarrhœa for three days in December, a recurrence in March, and frequent repetitions subsequently which only ceased after the stools had been examined in May, the *Entamœba histolytica* recognized, and appropriate treatment instituted. Another patient gave a history of an attack of dysentery in June in Mesopotamia, which lasted for some weeks, and was succeeded by chronic diarrhœa which sometimes ceased for many days at a time. His stools however, were never formed, and in November contained *E. histolytica*. Less commonly the symptoms are those of diarrhœa from beginning to end. One patient had diarrhœa on his way to Egypt in April, 1915, at Chatby in May, and on four subsequent occasions, none of which necessitated treatment in hospital. In October, 1916, it recurred so severely that he had to go to hospital, where, however, he was only detained for six days, and then sent to Montazah Convalescent Hospital. The diarrhœa recurred at once, and examination of the stool revealed *E. histolytica*. The attacks of diarrhœa were never severe, but might last for a fortnight at a time. He had no tenesmus, and never to his knowledge passed either blood or mucus with the stools.

A double infection is by no means uncommon, and occurred in twelve of our cases, entamœbæ and a dysentery bacillus being detected in the stools. But in amœbiasis, associated with dysenteric symptoms, the majority of patients show no dysentery bacilli. Other bacteria, however (*B. Morgan*, *B. fæcalis alkaligenes*, *B. paracolon*, *B. C.L.A.* 1, *B. C.L.A.* 2,[1] streptococci, etc.), are commonly present, sometimes in enormous numbers, and, whether capable or not of originating dysenteric symptoms in normal intestines, may quite conceivably produce them in a bowel already invaded by entamœbæ. And this, we think, is the explanation of the variation in the symptoms met with in amœbiasis, variations which are dependent upon difference in the site and the degree of the amœbic invasion; and in the kind and the mass of the bacterial infection.

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[1] C.L.A. type of bacilli. A number of organisms of the Morgan group of intestinal bacilli have been isolated at the Central Laboratory, Alexandria, and have been designated *C.L.A.*, *No.* 1, *No.* 2, etc. These organisms are feebly pathogenic to animals, and are probably diarrhœa producers in man.

The failure to recognize the double character of the cause in cases where it exists may have a tragical ending. In the majority of such cases the subsidence of the febrile and toxic symptoms unaccompanied by the usual associated improvement in the character of the stools suggests the presence of the protozoal infection, or this may be recognized on repeated examinations of the stools, and appropriate treatment secures the desired result. In one case we failed to appreciate this point.

The patient, a seaman on a trawler, dined in town on October 10, 1916, and acute dysentery succeeded next day, the abdominal pain being severe and the tenesmus constant. When he was admitted into hospital on October 10, 1916, he was much exhausted and looked toxic and ill. The tongue was thickly coated, the abdomen flat and mobile but tender in the iliac fossæ, and the stools were numerous and composed of bloody mucus. The pulse was febrile and numbered 101. The temperature ran between 100° and 102° F. In the days succeeding his admission his condition improved to some extent. The fever persisted, but the stools became less frequent and fæcal and the blood lessened in amount; on October 14, 1916, some small superficial sloughs were recognized in the stools. On October 19, 1916, he seemed better, the stools being less frequent and less fluid, with no blood or mucus, though some exudate was present, while his general strength was well maintained though he was appreciably thinner. The abdomen, too, was slightly distended and occasionally he had some pain. During the ensuing week, however, he continued to lose ground. The fever persisted, assuming a hectic character and being accompanied by severe sweating. The diarrhœa continued, the stools still retaining the same character. Towards the end of the month vomiting ensued at intervals, the diarrhœa continued, and the abdominal pain recurred. The abdomen became slightly more distended, but no evidence of general peritonitis was manifest. He died of cardiac failure on the morning of November 1, 1916. Post-mortem examination showed a widespread amœbic ulceration of the colon with an acute bacterial infection of the unaffected mucous membrane.

The lower three feet of the ileum were also acutely inflamed. The whole course of the illness suggested a bacterial cause—the sudden acute onset, the evident toxæmia and the continued pyrexia; and this seemed confirmed by the result of the examination of the stools which failed to reveal the presence of any protozoa, while a dysentery bacillus—not fermenting mannite—was isolated on culture from the stools on October 12, 1916. On subsequent examination dysentery organisms were absent, but *B. Morgan* was isolated on several occasions, and an intestinal infection of non-specific character engrafted upon a dysenteric lesion was assumed to be the cause of his illness, the enterica group having been excluded by examination of the urine, the stools, and the blood. The protozoal infection was not suspected and was not treated. The patient was definite that his illness only commenced upon October 7, 1916, though the condi-

tion found post mortem must have existed for some considerable time prior to this date, the amœbiasis being thus latent. Death, of course, ensued as a direct result of a bacterial infection, but this might perhaps have been resisted if emetine treatment had been instituted on admission, and the protozoal infection overcome.

One other patient in this series died, but not as the result of dysentery. He was admitted into hospital from Mesopotamia and could give no account of his illness, as he was then mildly delirious. He died two days later. Post-mortem examination revealed a widespread pulmonary tuberculosis and one or two small healing ulcers (probably of amœbic origin) in the colon. A malarial infection was also present.

The diagnosis of amœbic dysentery is beset by many difficulties. In a general way the onset of symptoms is subacute or insidious, the course is essentially chronic, fever is absent or slight in degree (100° to 101° F.), and there are no toxic symptoms such as headache, malaise anorexia, prostration, etc., the picture contrasting strongly with acute cases of the bacillary type. But the onset may be acute, fever high, and general symptoms severe in cases where a bacillary infection is superadded, and all these may be absent in the milder bacillary infections.

An acurate diagnosis can only be made by microscopic examination of the stools. Macroscopic examination is insufficient, for in amœbiasis any type of stool may be present, and the only real test is the discovery of the *E. histolytica*.

A single negative examination is of little value, and in our cases the parasite was only found at the *first* examination in sixty per cent. In several instances it was only detected at the third or fourth, and in one case at the eighth examination. This is by no means surprising when we consider the relative bulks of the stool and of the morsel examined. The stools, too, must be fresh and clean, for cold and prolonged exposure to the atmosphere rapidly destroy the amœbæ, a result which also follows the admixture of stools and urine, and treatment by emetine. Microscopic search should always be made, too, in evident cases of bacillary dysentery, for the infection is often mixed. A laxative should be administered in every case and mucus, exudate, or sloughs of the mucus membrane examined in particular.

It seemed possible that the failure to recognize entamœbæ in the stools might be due in part at any rate to the co-existence of a bacterial infection destroying the parasites. In twenty-one cases in which entamœbæ were found the same stool was examined bacteriologically. In five cases a heavy bacterial infection was present (*B. dysenteriæ* mannite fermenter, *B. dysenteriæ* non-mannite fermenter, *B. fæcalis alkaligenes*, *B. paracolon* A., *B. C.L.A.* 1). In sixteen cases abnormal bacteria were absent.

In 23 of our cases (*E. histolytica* 18, *E. coli* 5), a protozoal infection was not recognized on the first examination of the stools. The bacteriological examination of these stools showed negative results in 13 cases,

but positive results in only 10 (*B. dysenteriæ* mannite fermenter 5, *B. dysenteriæ* non-mannite fermenter 1, *B. paracolon* A 1, *B. C.L.A.* 6, *B. fæcalis alkaligenes* 1, and streptococci 1). The other causes which have been suggested as reasons for the failure are thus more important than a coincident bacterial infection.

Another suggestion indicative of a protozoal cause of active dysentery is the presence of *E. coli* in the stools. We have been led to this conclusion by the satisfactory result of the administration of emetine in such cases, but we are unfortunately unable to give statistics upon this point. Mr. Savage, however, has kindly permitted us to publish his figures, which show that a double infection with histolytica and coli is nearly three times as common as a pure histolytica infection.[1] A pure coli infection is, however, more than twice as common as the double infection, so that the indication is merely suggestive. In acute dysentery, however, a pure coli infection is not quite twice as common as the double infection, and *E. histolytica* was present in forty-three per cent of the cases in which entamœbæ were found.

In cases where microscopic examination is impossible, and in fact in every case, due attention should be paid to the other data. The probable source of the infection and the nature of the dysentery there prevalent are particularly important. Cases which originated on the Peninsula, especially at Cape Helles, and in Mesopotamia, particularly if the early symptoms were slight and did not necessitate treatment in hospital, are most frequently amœbic. Recurring attacks of dysentery, chronic dysentery, and dysentery which fails to react to general treatment, and dysentery associated with enlargement of the liver, hepatitis and perihepatitis, are most generally amœbic in origin. Repeated examination of the stools, too, may reveal the cause even if the symptoms have subsided, and in one of our cases *E. histolytica* cysts were found for the first time in the first *normal* semi-solid stool passed after the commencement of the illness.

The treatment of amœbiasis of the intestines consists in the administration of ipecacuanha or emetine in sufficient doses over a sufficient length of time. The well-known discomforts produced by the administration of large doses of ipecacuanha given by the mouth have led to the almost universal use of emetine administered hypodermically. The current routine is to give twelve grains of emetine hydrochloride in one-grain doses at night. In a large number of acute cases this treatment is

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[1] Mr. Savage:—

	Pure *E. coli* infection	Pure *E. hist.* infection	Double infection
Alexandria: Dysentery cases ..	62 ..	15 ..	32
Bristol: Convalescent dysentery cases and convalescents	100 ..	11 ..	39
	162 ..	26 ..	71

successful, the symptoms lessening in severity after four to five days and rapidly disappearing, while the entamœbæ disappear from the stools. But in a considerable number of cases emetine given in this way has been shown to be insufficient, the entamœbæ reappearing in the stools, though the symptoms may be absent or trivial. In one of our cases twelve grains of emetine were given between June 8 and 19, amœbæ reappeared in the stools on August 1. In another case they were detected for the first time on August 12, though 12⅓ grains had been given between July 21 and August 6. (The earlier examination had been made after emetine treatment had been commenced.) Our experience in this coincides with that of Wenyon and O'Connor.

In another group the dysenteric symptoms persist. This is most usually in cases where the illness is chronic or relapsing, and where presumably ulceration of considerable severity and extent still obtains. It seems reasonable in such cases to give ipecacuanha or emetine by the mouth in the hope of reaching organisms in the crevices of chronic ulcers which are out with the reach of the blood-stream. We therefore follow up the hypodermic course of emetine by a course of ipecacuanha given by the mouth in five or ten-grain doses for a fortnight. So far as we know our cases thus treated have not relapsed, but we are, of course, unfortunately unable to secure reliable data of the history of our patients after their discharge from hospital.

It seems necessary still to emphasize the fact that a "ten-day course" will not cure amœbic dysentery. It is well known that such protozoal infections as malaria and syphilis require *prolonged* treatment to ensure a cure, and amœbiasis also requires prolonged treatment, even after the dysenteric symptoms have completely disappeared. The presence of dysenteric symptoms in amœbiasis indicates *active ulceration* of the bowel, and, like gastric and duodenal ulcer, amœbic ulceration requires time to heal. The statistics of Wenyon and O'Connor with regard to emetine treatment, and those of Savage and Young with regard to the treatment by the double iodide, afford confirmatory evidence of the correctness of our reasoning.

The rapid disappearance of dysenteric symptoms in amœbiasis has in our opinion led to an unwise shortening of the period of treatment in hospital with the result that relapses have been frequent, and the period of absence from duty unnecessarily prolonged. To put it in another way, "a stitch in time saves nine." Recent infections respond rapidly to treatment, but recurring cases with deep and large ulcers have as a rule to be invalided home, and are in consequence absent from the field for many months. We are unable to give statistics of the average duration of treatment in hospital of our acute cases, but it must have been between five and six weeks. An earlier dismissal was rarely possible on account of either local or general symptoms, and we invariably kept them in hospital until they had been for a week on ordinary diet without discomfort. They

were then sent to a convalescent home for a fortnight before their return to duty.

We have been unable to obtain membroids or such like protection for the ipecacuanha, but we have found that it rarely occasions sickness if given with thirty grains of bismuthi carb., and five grains of sodii bicarb. about 9 o'clock at night and three hours after the last meal. The patient was in bed for at least thirty minutes before the dose was administered.

We have used salol coated tabloids of emetine with apparently good results, but we dislike using tabloids on account of the impossibility of ensuring their disintegration within the bowel. Our supply of the double iodide of bismuth and emetine was limited and only allowed its use in three cases; in two the result was satisfactory. The tabloids are keratin coated, and given immediately after meals sometimes excited a little nausea, but only rarely actual vomiting.

We have invariably kept our patients in bed *during* the emetine course, though they were subsequently allowed up for a few hours each day during the ipecacuanha course, if their general condition permitted. We have had no serious symptoms in any case, but our patients, if in poor health, have not infrequently complained of nausea, giddiness, weakness, etc., on exertion, and in consequence we have refrained from permitting any exercise. We have tried Wenyon's plan of giving emetine simultaneously by the bowel and hypodermically, but these general symptoms seemed intensified by this measure and we in consequence adopted the sequence detailed above, with satisfactory results.

Captain Lumb informs us that he obtained good results in East Africa prior to the War by continued treatment with emetine hypodermically. He gave it daily until the symptoms disappeared, and then twice weekly for a month, and once a week for another month. We have had no experience of this method of treatment.

Bacillary Dysentery.

The symptoms of bacillary dysentery are quite as varied and confusing as those of the amœbic variety.

In the typical acute case the onset is abrupt, the patient being suddenly seized with severe diarrhœa, accompanied by griping pains in the abdomen; and in the course of a few hours the stools lose their copious watery fæcal character, and become small in bulk, though even more numerous than before, and composed of blood, or blood and mucus. Tenesmus is extreme, and the patient refuses to relinquish the bedpan or to leave the latrine, while the abdominal pain continues, intensified from time to time with the passage of a stool. The abdomen, too, is exquisitely tender to the touch. And with these local symptoms there is fever, the temperature reaching 101° to 102° F., and all the usual signs of toxæmia, headache, anorexia, nausea, furred tongue, hot skin, and frequent bounding pulse.

On the second or third day his appearance is fairly characteristic. The face is flushed, and his eyes are languid, the patient being wholly absorbed in his own discomforts, and indifferent to his surroundings. But at the same time the brain is unclouded and the intelligence acute, and the dazed lethargic features of enterica are absent—though he will doze indefinitely unless aroused by a call to stool. The fever is usually remittent or intermittent, and rarely touches 103° F. Exhaustion is extreme from the pain, sleeplessness, and starvation; but the pulse is usually not unduly frequent, running about 90, and is of fair quality. An increasing pulse-rate, or one over 100, is of more serious significance than the height of the fever or the number of the stools.

The whole picture—the facies, the toxæmia, the fever, etc.—are those of an acute bacterial infection, in which gastro-intestinal symptoms are prominent.

The subsequent course of events varies greatly in different cases. In some the attack is short, the fever disappearing within forty-eight hours, while the diarrhœa rapidly ceases, and the blood disappears from the stools. In others the fever persists, and may last for a week, or rarely for a fortnight, while blood and pus and mucus continue present in the stools. There is no difficulty in these cases in recognizing the bacterial origin of the illness.

But in another group the symptoms can hardly be separated from those of the amœbic type. Two men were admitted into hospital on the same day from the same camp. One had arrived in Egypt from England on December 27, and on December 30 dysentery ensued, accompanied by considerable abdominal pain. His temperature on December 31 was 100° F., and the stools consisted of bloody mucus. On January 1 the fever and abdominal discomfort had gone, while the stools consisted of bloody muco-pus. On January 3 the blood had gone, and the stools were fæcal, with a little cellular exudate, which in its turn had disappeared on January 5. The recent arrival of the patient in Egypt, and the acuteness of the symptoms at the onset, made the diagnosis clear even before a dysentery bacillus was isolated on culture, and the absence of entamœbæ determined by the microscope.

The second patient had been taken ill on December 25 with similar symptoms, had gone sick on December 27, and was admitted on December 31. He had then no fever and no abdominal discomfort save in a slight degree when at stool; while the stools at first fæcal only showed the presence of blood and mucus on January 2, forty-eight hours after admission, and seven days after the onset of the symptoms. He had been in Egypt for a year, and had always been liable to diarrhœa though it was never severe, and had never necessitated his admission to hospital. A history of chronic diarrhœa, a subacute onset, an afebrile illness, but again due to a dysentery bacillus.

Diarrhœa, too, may be due to a dysentery bacillus. A man was admitted

to hospital on December 21 on account of diarrhœa, which had ensued two days previously. He said that he had passed some blood and slime on the morning of the day of admission, but the stools after admission were always fæcal, without addition, and after December 26 formed. The number of stools passed per diem after admission was 3, 1, 1, ——, 1, 1, 1, 1, but on December 23 a dysentery bacillus was isolated. Another man whose stools were examined in the course of an investigation into the flora of the stools in Egypt, and found to contain a dysentery bacillus, had had diarrhœa for a couple of days immediately before the stool—a normal one—was investigated. Dysentery carriers are by no means uncommon. The majority of the cases discovered had at some time suffered from diarrhœa or dysentery; but one man who had been on the Peninsula from September 15 until the evacuation, and subsequently in Egypt, and whose stools contained a dysentery bacillus on September 20, 1916, and on October 11, 1916, would not admit having ever had any diarrhœa or dysentery since he came East, and had never been off duty on account of illness save for a couple of weeks in June, 1916, when he had "inflammation of the lungs."

The same series, then, obtains in bacillary dysentery as in amœbic dysentery, and while the severe cases in the two groups present distinctive pictures, the milder forms are practically indistinguishable; in both diarrhœa rather than dysentery may prevail; and in both gastro-intestinal symptoms may be in complete abeyance.

Like others we have at times imagined that the character of the stools conveyed a definite indication of the cause of the illness. And arguing in some measure from comparison with the secretions in acute coryza, we have thought that mucus or muco-pus, streaked with blood, and fluid-purulent stools were characteristic of bacillary cases; while a copious crimson stool and a fæcal stool, studded with sago-like masses, were characteristic of the amœbic variety. But increasing experience has taught us like others that no reliance can be placed on such criteria, and that *every type of normal and abnormal stool* may be present with amœbic and with bacillary infections of the bowel. After all, mucus comes from inflamed mucous membrane, pus comes from the same source or from an ulcer, blood flows from a ruptured or congested vessel; and inflammation of the mucous membrane of varying degree, and ulceration, may and do obtain in both forms of the disease.

The general features of the illness, an epidemic character, batches of patients coming at the same time from the camp, an acute onset, high fever and severe toxæmic symptoms, are the most characteristic symptoms of bacillary dysentery, but the only sure test is the recognition of the specific cause in the stools. Extreme exhaustion, for instance, may closely simulate toxæmia, and a rough passage on a hospital ship from the Western Front so exhausted one of our patients that we had little doubt on his admission that his illness was bacillary, though it turned out to be a pure amœbic infection.

A point of considerable practical importance may be considered here. In more than half (58·8 per cent) of the cases with blood and mucus in the stools examined microscopically and bacteriologically, no dysentery bacilli or entamœbæ were detected, and the cause of the illness remained undetermined.[1]

It has been suggested that the absence of dysenteric bacilli from the stools is merely a question of the stage of the disease; that in dysentery the specific bacteria cannot be recovered from the stools after the first few days, as they either die out or become submerged in the general flora of the inflamed bowel. As Major Ferguson puts it, the ground may still be wet, though the shower has ceased.

It is quite true that mucus and blood and pus may persist after dysentery bacilli have ceased to be recovered. In one of our cases no dysenteric bacilli were isolated after the fourth day, though blood and mucus were present in the stools as late as the ninth day. In another case blood and pus were present on the eleventh day, though bacilli were absent after the ninth. But in other cases the bacilli may persist after blood and mucus and pus have gone, and when the stools are normal. In 15 out of 28 cases in which the stools were examined repeatedly, bacilli were present in the second week, and in 3 in the third week. In one case they persisted until the eighteenth day, and were found subsequently on the twenty-fifth. In three cases they had disappeared after the fourth day.

Their presence, too, or at any rate their recognition, may be intermittent. We have found them present on the fourth and fifth days, absent on the sixth, and present on the eighth and ninth; present on the sixth and seventh, absent on the eighth, and present again on the ninth day. Isolated observations are of little value, and repeated examinations are required if the bacillary cause is to be fairly excluded. But the number of cases in which they are not detected seems too large to be explained in this way, and their absence must be accounted for by other circumstances.

(To be continued.)

[1] Central Laboratory, Alexandria, April to December, 1916: 838 cases with blood and mucus in the stools were examined; 78 cases showed *E. histolytica*, and 278 *B. dysenteriæ* = 41·2 per cent; 173 cases showed atypical, i.e., inagglutinable *B. dysenteriæ*.

Clinical and other Notes.

ON A CASE IN WHICH A MACHINE-GUN BULLET WAS EMBEDDED IN THE WALL OF THE HEART, WITH OBSERVATIONS ON THE CARDIAC MOVEMENTS OF THE BULLET DURING SYSTOLE AND DIASTOLE AND THE TRANSLATION MOVEMENTS DURING RESPIRATION AND CHANGES IN BODILY POSITION.

By Colonel C. J. BOND, C.M.G., A.M.S.

AND

Captain E. V. PHILLIPS.

Royal Army Medical Corps.

AND

W. JEVONS, M.Sc.

Pte. J. W. H. was wounded on September 29, 1917, while lying on his back, by a bullet from the machine-gun of an aeroplane. The healed wound of entrance is small and situated 1½ inches below and 1¾ inches internal to the left nipple.

An X-ray examination of the chest taken in January, 1918, at the 5th Northern Hospital revealed the presence of a bullet at a depth of about five centimetres from the surface of the body apparently embedded in the wall of the left ventricle near the apex and moving with systole and diastole and with the respiratory movements of the diaphragm. The bullet lies with its point directed towards the mid-line slightly backwards, and during normal respiration somewhat upwards (see fig. 1).

On deep inspiration the point of the bullet travels downwards so that in addition to lying on a lower level the bullet assumes a horizontal position, while in deep expiration it returns to the vertical position with the apex pointing upwards and slightly inwards. These respiratory translation movements are quite independent of the to and fro systole and diastole intrinsic movements which will be described later.

The composite diagrams, figs. 1 to 7 represent actual tracings on the fluorescent screen drawn under the same conditions of position of tube and screen and on the same scale. In each of the diagrams the letter B represents the shadow of the bullet, H the left border of the heart, D the left crest of the diaphragm. The suffixed letters I and E represent the position at full inspiration and expiration respectively. Where the right border of the heart is indicated the line is traced in the inspiratory position. A mid-position of the bullet between systole and diastole is indicated by the broken line. N represents the position of the left nipple. The borders of the vertebræ are outlined in correct position but the rib shadows have been omitted for the sake of clearness. The relation of the ribs to the heart and bullet were determined by X-ray photographs.

The alternating cardiac movements somewhat blur the outline of the cardiac shadow and that of the bullet, but in as much as the diastolic interval considerably

exceeds in the aggregate that of systole the shadows formed by the bullet and the heart correspond approximately to the position assumed during diastole.

We may now consider all observed movements of the bullet under three heads:—

(1) *The Effect of Alterations in Bodily Position on the Position of the Heart.*—The level assumed by the bullet with the body in the erect position is lower by half the depth of the eleventh vertebra than the level assumed with the body in the supine position. The bullet shadow also approaches the mid-line in the erect position. The effect of forced inspiration causes the apex of the bullet to point somewhat downwards in the erect position while it is practically horizontal in the supine position. The alteration of outline of the left hand border of the cardiac shadow and its distance from the nipple line roughly coincide with these changes in the position of the bullet shadow in the erect and supine positions.

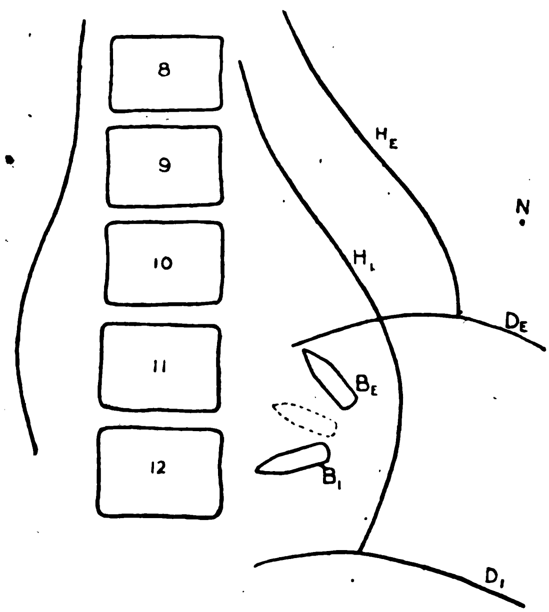


FIG. 1.—ERECT.

The greatest difference in lateral deviation of the bullet shadow is obtained by placing the patient on his right and left side respectively. When lying on the left side the bullet shadow closely approaches the nipple line, whereas when lying on the right side it almost reaches the left border of the spine.

(2) *The Effect of Respiratory Movements on the Bullet Shadow.*—During expiration the motion of the bullet has three components: (*a*) A translation upwards; (*b*) a rotation clockwise, as viewed from the front, in which the excursion of the apex of the bullet is greater than that of the base in each case; (*c*) a lateral motion of translation. This lateral movement is (on expiration) outwards away from the mid-line when the patient is standing or lying on his back or left side (see figs. 1, 2, 3), so that, neglecting any antero-posterior

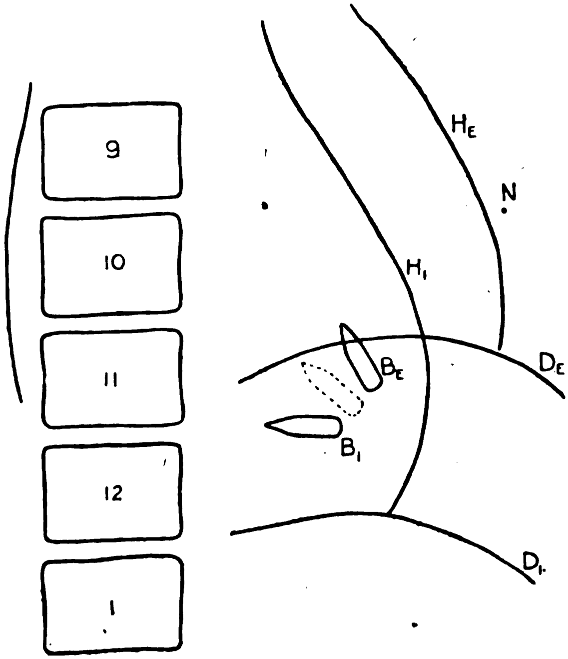


FIG. 2.—SUPINE.

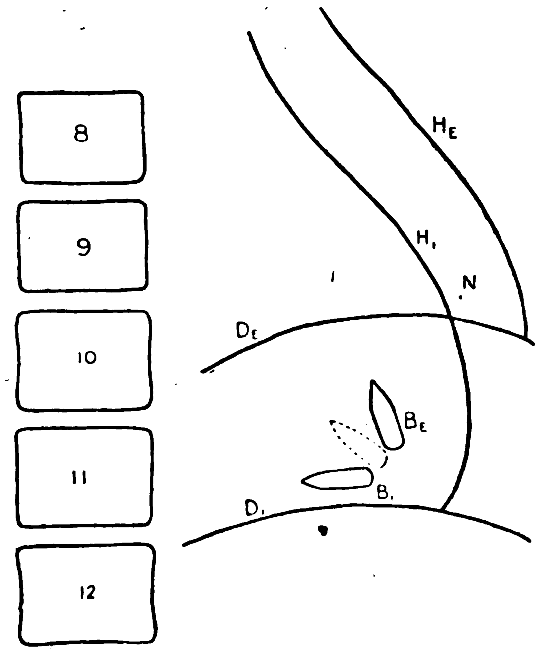


FIG. 3.—LYING ON LEFT SIDE.

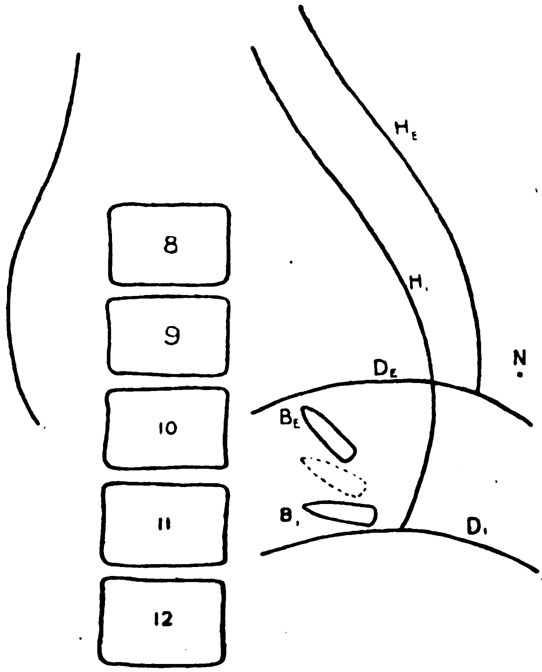


Fig. 4.—Prone.

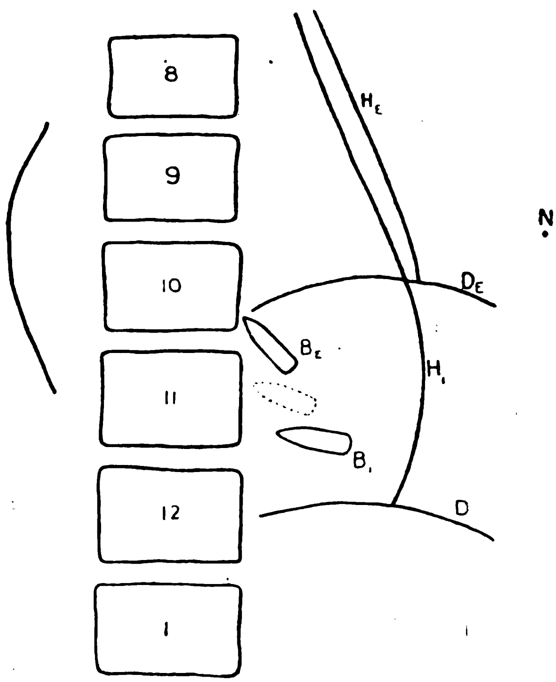


Fig. 5.—Lying on Right Side.

component that may be present the resultant movement is of the same type in these three positions. On the other hand, this lateral movement (also during expiration) is inwards towards the mid-line when the patient is lying on his face

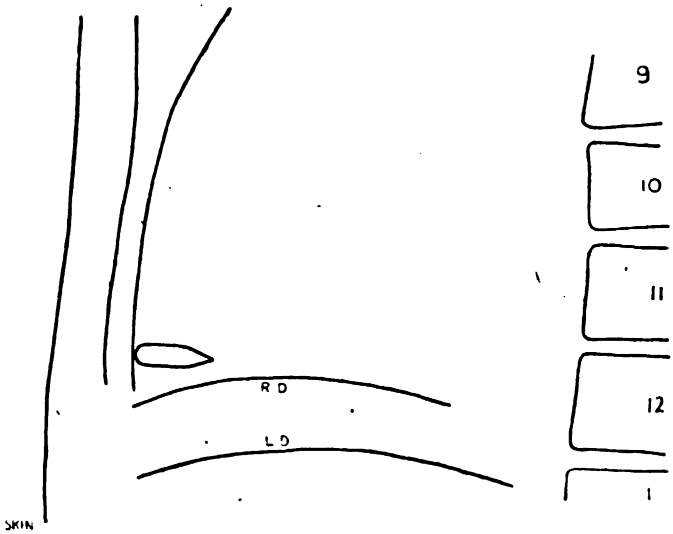


Fig. 6.—Lateral (Supine).

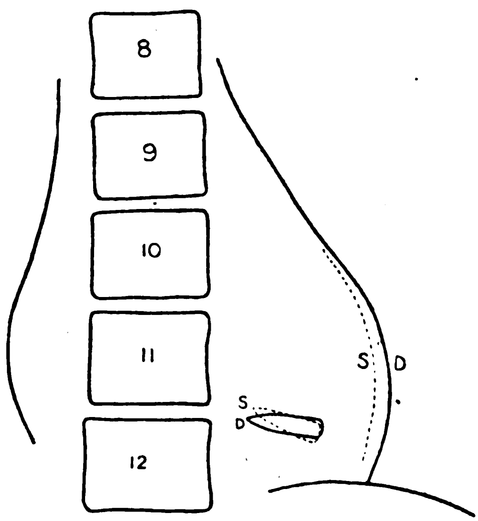


Fig. 7.—Diastolic and Systolic Relationships.

and on his right side (see figs. 4, 5), the excursion is greater in the latter than in the former position. In the prone and right-sided positions the movement of the bullet which accompanies the descent of the diaphragm in deep inspiration may be described as a dive downwards and outwards. The intermediate positions

taken correspond to those assumed by a diver when passing through the water from the vertical, through the horizontal to the reverse vertical position. The base of the bullet represents the head and the apex the feet of the diver. In the erect, supine, and left-sided positions, on the other hand, the bullet movement may be described as a fall into the water with the diver in the horizontal position with a tendency for the feet to travel backwards. An attempt was made to observe the respiratory movements of the bullet with the patient in the inverted recumbent position, both prone and supine. In the inverted supine position the respiratory movements of the bullet are practically the same as in the level supine position (see fig. 2), while in the inverted prone position the movement is much more restricted. In both inverted positions the heart shadow and the crest of the diaphragm assume a higher level.

It will be noticed that the upward movement of the bullet shadow during full expiration is in all positions less than that of the crest of the diaphragm. This is due to the fact that the bullet lies in the portion of the ventricle which occupies the angle between the diaphragm and the wall of the chest and not that portion which rests on the summit of the diaphragmatic dome.

(3) *The Intrinsic Movement of the Bullet during Cardiac Systole and Diastole.*—The continuous lines marked D in fig. 7, are copied from an X-ray photograph. They represent the relative positions of the left border of the heart and the bullet during moderately deep inspiration in the erect position. They approximate to the positions marked H1 and B1 in fig. 1. The position of the left hand border of the heart and the bullet at the instant of cardiac systole are shown by the broken lines S. It will be seen that the excursion of the point is greater than that of the base of the bullet and opposite in direction to that of the left border of the heart. Thus the apex of the bullet and the left border of the heart tend to approximate during systole. The movement of the base of the bullet is very small and as far as can be observed is opposite in direction to that of the apex. It is probable that the diastolic and systolic relationship in the bullet motion is roughly the same in all positions of the heart as no observational evidence was obtained to the contrary.

Remarks by Colonel C. J. Bond.

The evidence obtained in this case on the whole confirms the earlier observations carried out by the late Sir Victor Horsley and myself on animals at the Brown Institution in 1882, and by myself on the human subject by means of an air bag introduced into the œsophagus connected up with a tambour and recording drum. By this means records were obtained of the base beat of the heart and of the effect of variations in bodily position on the position of the heart and on intra-auricular pressure. These observations were published in the *British Medical Journal* on December 12, 1885. The evidence in the present case shows that the heart sits upon and by its under surface moulds itself to the convex dome of the diaphragm, at any rate during the uncontracted diastolic phase. It also occupies the angle between the thoracic wall and the rising diaphragm. The bullet lies apparently in that portion of the ventricle which occupies this angle. The chief movements of the heart in the chest brought about by changes in bodily position are lateral side to side movements and up and down alteration in level movements. Direct observation of the bullet shadow on the screen reveals

the great amplitude of these lateral movements when the patient turns from his right to his left side. The upward and downward movements are more complicated and differ in different bodily positions and in alternating phases of respiration.

Thus in the erect, the sloping supine, and the left sided positions, in all of which the heart moves freely, the effect of the descent of the diaphragm in inspiration is to cause the apex of the heart to fall, and while falling to pass a little inwards towards the mid-line. The heart assumes a more vertical position in the chest. Whereas in the right sided position, and partly in the lying prone position, the heart apex falls on inspiration, but it also passes somewhat outwards towards the nipple line. The heart lies more horizontally than in the other positions. In seeking for some explanation of this change in direction of heart movement during respiration according to bodily position we find that in forced expiration the bullet shadow passes through the same phases of movement in the reverse order. We know that with the patient in the right sided position the heart tends to recede from the chest wall in the nipple line and to fall back on its base on the spine. In these figures a larger area of cardiac shadow appears to the right of the spine and at the same time the extension of the left border of the heart on deep expiration is much less in the right sided than in the left sided or the erect positions (compare fig, 5, H*e* and H*i* with fig. 3, H*e* and H*i*). The same thing occurs to a less degree with the patient lying on his stomach, this is probably due to the pressure of the abdominal viscera on the diaphragm.

What happens then in forced expiration during the rise of the diaphragm and the falling in of the chest wall is this:—

In all bodily positions the portion of the heart which lies on the diaphragm is raised, but while in the erect, the sloping supine, and the left-sided positions this elevation is accompanied with a spreading outwards to the left, in the right-sided position the heart falls backwards and to the right on its own base, and when the diaphragm rises in forced expiration the portion of the heart resting on the diaphragm and the apex, which in this patient contains the bullet not only rises but passes inwards towards the spine.

The physiological and pathological effects on the function of the heart brought about by changes in bodily position both in man and animals were described in the paper previously published (see *British Medical Journal*, December 12, 1885).

A series of electro-cardiograms was taken but no change referable to the presence of the bullet was observed.

I wish to record my thanks to Sir James Mackenzie for his kind advice in this case, and especially to Mr. Jevons for the skill and care with which he has traced and recorded the cardiac movements.

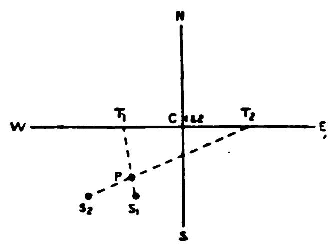
A SIMPLE METHOD OF X-RAY LOCALIZATION.

By Captain D. B. McGRIGOR,
Royal Army Medical Corps.

The following is a simple and rapid method of carrying out a complete localization without the use of any expensive apparatus.

First, make the two ordinary exposures necessary for the Mackenzie Davidson method, accurately centring your tube over the cross wires and moving the

Fig. 1.



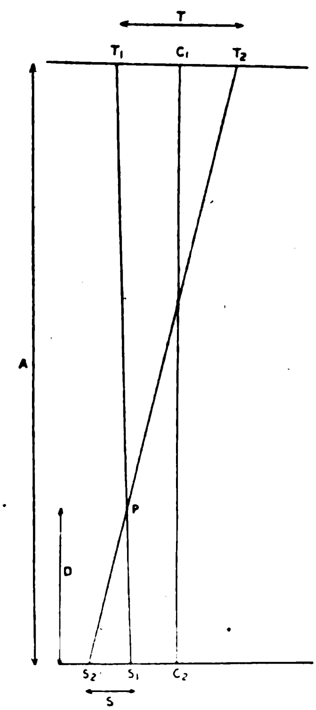


Fig. 2.

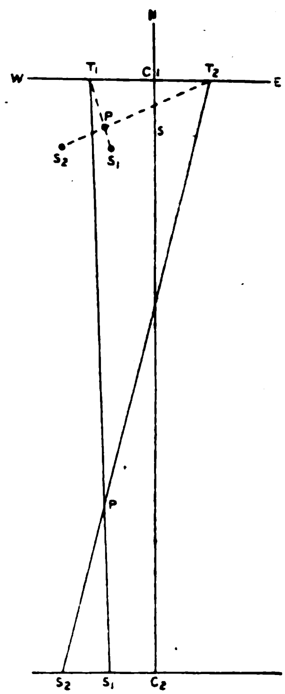


Fig. 3.

tube the usual three centimetres to each side. Both exposures can be taken on one plate, as this not only saves time and plates, but also does away with the necessity for using a plate changing box. After developing, copy the cross

line markings which are on the plate and also on the patient's skin on a sheet of paper, as in fig. 1, along with the position of the two shadows S1 and S2.

Mark the position of the tube before and after movement T1 and T2. Join T1 and S1 and T2 and S2, the lines intersecting at P. Obviously this is just a plan view of the Mackenzie Davidson localizer, with the advantage that the point P indicating the position of the foreign body is mathematically transferred to the plane of the negative instead of being worked out mechanically.

Second, all that is now required, besides marking point P on the patient's skin, is to find the depth of the foreign body. This can be done either by means of the well known formula $\frac{A \times S}{T + S} = D =$ depth, A being the distance of the tube to the plate, T the movement of the tube, and S the movement of the shadow; or by a simple drawing on the paper which is practically the same as the method mentioned by Dr. Hampson in the *Archives of the Röntgen Ray* for November, 1914, pp. 203. This time, as the drawing (fig. 2) is obviously an elevation view of the localizer, mark the position of the two shadows S1 and S2 on the plate level C2, C1, C2 being the distance that you are working at between the tube and the plate. Again join T1 and S1, and T2 and S2, which intersect at P the elevation position of the foreign body. Now the depth D can been measured at once.

Having found the position (P in fig. 1) and the depth (D in fig. 2) of the foreign body, you have all the information required, absolutely mathematically correct, in contrast to the mechanical errors which may creep in when working with cross threads and planes.

Figs. 1 and 2 can be combined to save time as in fig. 3.

The use of N., E., S., W., for skin markings prevents any mistake occurring such as marking the wrong quadrant on the patient's skin.

A CASE OF SUPPURATIVE MENINGITIS WITH GLYCOSURIA, SIMULATING DIABETIC COMA.

By FRANK E. TAYLOR, M.D., B.S., M.R.C.P.Lond., F.R.C.S.Eng., D.P.H.Camb.
Pathologist and Bacteriologist to the Queen Alexandra Military Hospital; Lecturer on Bacteriology, University of London, King's College.

AND

Captain W. H. McKINSTRY.
Royal Army Medical Corps.

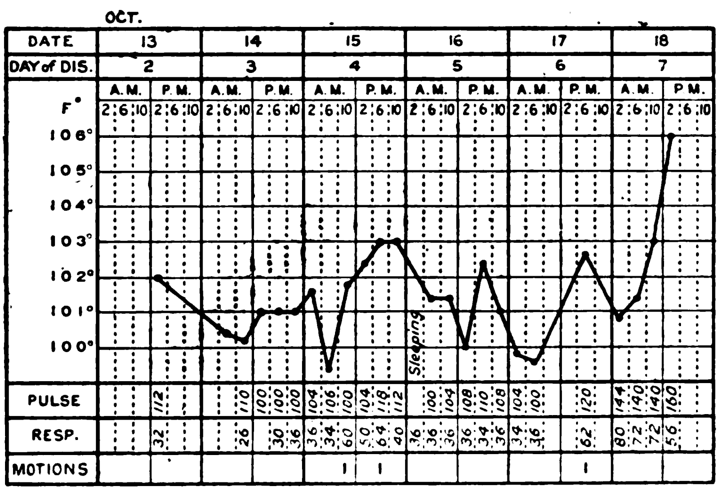
On October 13, 1916, the following case was admitted into the Queen Alexandra Military Hospital, and was thought worthy of being placed on record on account of several interesting points to be discussed later:—

Second Air Mechanic E., of the R.F.C., aged 36, with four months' service had been ill for twenty-four hours, complaining of severe pain in the right side of the chest, cough, and difficulty of breathing.

Condition on Admission.—The patient appeared ill, with flushed face and marked dyspnœa. The temperature was 102° F., the pulse-rate was 112 and the respirations 38 per minute. Examination of the chest revealed diminished

expansion of the right lower chest, withst ony dullness and absence of tactile vocal fremitus and breath sounds over the right lower lobe. Typical "rusty" sputum was being expectorated, and the case was diagnosed as one of pleurisy and pneumonia.

Treatment.—Poultices were applied to the chest. Calomel three grains and pulv. ipecac. co. grains x were ordered *statim.* October 15, 1916: Patient has bad a bad night. Pain was intense so that patient could not lie comfortably in bed. The temperature still ranged from 101° F. to 103° F. The pulse was of good quality with a pulse-rate of 100. The respirations were very rapid rising to 60 per minute. The physical signs in the chest remained the same, no signs of fluid being present. There was no cyanosis. The heart and pericardium were normal. The application of leeches to the right side of the chest caused great relief of the pain almost immediately and a stimulant expectorant mixture was prescribed.



Temperature chart showing rise of temperature to 107° F. before death.

October 16, 1916: Patient appeared to be greatly improved, said he felt quite well and was very cheerful. The temperature was 102° F., pulse 100 and respirations 36. There was very little cough and no expectoration.

October 17, 1916: The ward sister noticed some twitching of the patient's face; he had previously complained of intense headache. He vomited immediately afterwards and became very collapsed with incontinence of fæces. Coma rapidly supervened, with dilated pupils which did not react to light. Conjugate deviation of the eyes was noted first to the left and then to the right. All the superficial reflexes except the conjunctival were lost. Later he became very restless, constantly picking at his face which wore a perpetual frown. The respirations rose to 64 and presented the appearance of air hunger. The pulse still remained of good quality, being 100 to the minute. He had retention of urine and a catheter was passed drawing off twenty ounces of urine. On examination this contained a trace of albumin and a few hyaline and granular casts, as well as a large amount of sugar (not estimated quantitatively) but acetone and

diacetic acid could not be detected. No distinctive odour of his breath could be recognized by any of several observers who examined him with this in view. Further, no history suggestive of glycosuria—excessive thirst, wasting or polyuria—could be elicited on cross-examination of his wife; his health before this attack seemed to have been very good. An attempt made to administer alkalies subcutaneously was unsuccessful on account of the patient's restlessness, and rectal salines met with no better results. He could not take anything by the mouth. The patient's condition remained much the same during the night.

October 18, 1916: The respirations were now 80 and the pulse 144, and inclined to be irregular. His colour had much improved. The pupils were no longer dilated. He appeared to be temporarily paralysed on the left side, and had conjugate deviation of the eyes to the left. Incontinence of urine now developed, but a sample of urine was collected and found to be quite free from sugar, whilst the quantity of urea present was normal. Venesection was performed, twenty ounces of blood being removed and two pints of normal saline containing one per cent sodæ bicarb. were injected into the vein. Later the eyes became deviated to the right, the pulse got weaker, Cheyne-Stokes respiration developed, he became cyanosed, spasms of the jaw and muscles of both arms were noted, and the patient died at 3 p.m. Just before death the temperature rose to 107° F. A copy of the temperature chart is appended.

POST-MORTEM EXAMINATION.

The post-mortem examination was made thirty-six hours after death. The body was well-nourished and showed no signs of external injury except a hæmatoma about the size of the palm of the hand between the umbilicus and left anterior superior spine of ilium.

Thorax.—The whole of the pleura covering the right lung was covered with a layer of semi-membranous purulent exudation about a quarter of an inch thick, which could easily be peeled off. The left lung and pleura appeared healthy. There was no free fluid in the pleural cavity.

The heart appeared normal and there was no pericardial effusion. The vessels about the base of the heart and the structures in the mediastinum were normal.

Abdomen.—All the organs, including the kidneys and liver and pancreas, appeared healthy.

Brain.—On removing the outer coverings of the brain, pus was found mapping out the sulci on the anterior, superior, posterior lateral and internal surfaces, and also the course of the blood-vessels. When the brain was removed the base was found free from pus except for a small area on each side where the middle meningeal artery takes its origin. The upper surface of the cerebellum was thickly covered with pus, particularly in the region adjoining the mid-cerebrum. The other surfaces of the cerebellum were free from pus. No pus could be found about the medulla. The brain when cut into showed no sign of abscess or excess of fluid in the ventricles.

Smears taken direct from the pus in the sulci, stained by Gram's method, showed long chains of streptococci as well as staphylococci. Streptococci were also found in smears from the cerebrospinal fluid and in the blood drawn direct from the seared heart.

Media of agar broth and trypsin broth, legumin agar inoculated from the

blood and the pus from the brain and pleura, incubated at 37° for twenty-four hours and examined, showed growths of streptococci, *Staphylococci aureus*, and a large Gram-positive sporing organism, the last being no doubt due to post-mortem invasion of the tissues.

Although the nature of this case as one of suppurative meningitis with transient glycosuria was plainly revealed by the post-mortem examination, the recognition of the cause of the sudden coma formed a difficult and perplexing problem during life. It was in the attempt to settle this question that the urine was sent for examination, and when it was found that it contained a large quantity of sugar, the diagnosis of diabetic coma was raised. The absence of polyuria and of acetone and diacetic acid in the urine, as well as the absence of the characteristic sweetish acetone-like odour of the breath, rendered this diagnosis a very questionable one.

The question of uræmic coma was next raised, seeing that albumin, though in small amount, as well as a few hyaline and granular casts were found in the urine. The determination of the percentage of urea was then suggested, and for this purpose a further specimen of urine was obtained on the following day. The percentage of urea was found to be normal (i.e., two per cent), and this fact was taken as disposing of the diagnosis of uræmic coma.

A quantitative determination of the sugar was then decided upon, but in this specimen no trace of sugar or other Fehling reducing substance could be obtained, showing that the glycosuria was only a transient condition.

Lastly, the terminal hyperpyrexia, the temperature rising just before death to 107° F. which occurs not uncommonly in infective conditions, is an interesting point to note.

As regards the relationship between diabetic coma and the presence of the acetone-bodies in the urine, Cammidge [1] states, that "all cases of diabetes are not complicated by acetonæmia, although it is a constantly present menace, since a deficiency in the oxidative processes of the body is an essential element of the condition. It is only when this reaches a certain stage that the acetone bodies appear in the urine *as a necessary consequence*."

Further, he states that acetone and aceto-acetic acid, though usually present in the urine when the coma supervenes, are not as abundant as before, but that the amount of beta-oxybutyric acid is generally much increased.

The completed history of the case, with its transient glycosuria, indicates the neurogenous origin of the glycosuria. Regarding this condition, Cammidge [2] states, that "such a transitory glycosuria, apparently of central origin, has been noticed in connexion with lesions of both the central and peripheral nervous system, such as tumours and hæmorrhages at the base of the brain, lesions of the floor of the fourth ventricle, *cerebral and spinal meningitis*. Concussion of the brain, fracture of the cervical vertebræ, tetanus and sciatica. It has also been met with after epileptic, hystero-epileptic and apoplectic seizures, in traumatic neuroses, such as those following railway accidents, mental shocks, mental strain, worry, fatigue and great anxiety."

The practical lesson which this case enforces is the danger of concluding that the presence of sugar in the urine of a comatose individual is necessarily due to diabetic coma. Further investigations and a critical survey of the history of the case are essential for the accurate elucidation of the cause of this condition.

We have to thank Captain H. S. Morton, R.A.M.C., for the clinical history of this case, and Surgeon-General J. Dallas Edge, C.B., A.M.S., commanding the Queen Alexandra Military Hospital, for permission to publish it.

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[1] CAMMIDGE, P. J. "Glycosuria and Allied Conditions," Lond.: Ed. Arnold, 1913, p. 214.
[2] *Loc. cit.*, p. 169.

SUSCEPTIBILITY TO CEREBROSPINAL MENINGITIS IN RELATION TO AGE.

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IN continuation of our studies into the etiology of cerebrospinal fever, we have been led to investigate the most susceptible age for the appearance of the disease. Theoretically, as will be seen presently, the question is of considerable interest in its bearing on etiology. Practically, it is also of importance in view of the fact that many diseases are to-day recognized as showing age incidence; the latter often playing a prominent part for the clinician in the differential diagnosis of numerous conditions.

For the purpose of the present study we have taken data, collected by ourselves, arising out of the epidemics of 1914-16 and of 1915-16, in the Dorset Military District.

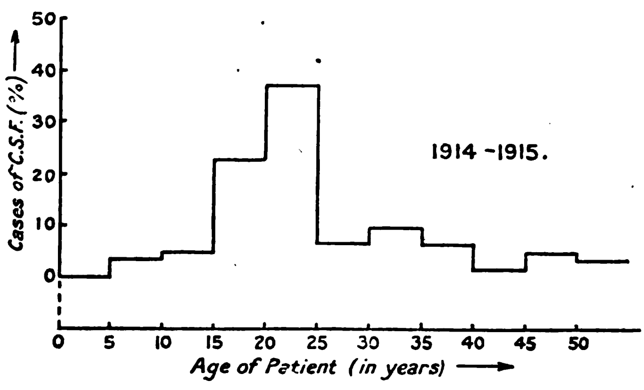

FIG. 1.

With regard to the epidemic of 1914-15, of thirty-one cases (civil and military) of the disease, about whom accurate information as to their ages is available:—

3·22	per cent	occurred in	persons	from	5 to 10	years	of	age
4·84	,,	,,	,,	,,	10 ,, 15	,,		,,
22·58	,,	,,	,,	,,	15 ,, 20	,,		,,
37·10	,,	,,	,,	,,	20 ,, 25	,,		,,
6·45	,,	,,	,,	,,	25 ,, 30	,,		,,
9·68	,,	,,	,,	,,	30 ,, 35	,,		,,
6·45	,,	,,	,,	,,	35 ,, 40	,,		,,
1·61	,,	,,	,,	,,	40 ,, 45	,,		,,
4·84	,,	,,	,,	,,	45 ,, 50	,,		,,
3·23	,,	,,	,,	,,	over 50	,,		,,

On plotting the percentage of cases as ordinates, and the corresponding age-periods as abscissæ, these numbers give the graphical representation of fig. 1.

This figure shows that for the epidemic of 1914-15, so far as the Dorset District is concerned, the *apparent* most susceptible age is between 20 and 25.

In regard to the epidemic of 1915-16, of sixty-two cases (civil and military) occurring in the district from the beginning of July, 1915, to the end of June, 1916, their distribution in terms of age is as follows :—

1·61	per cent	occurred	in persons	under .. 5	years	of age
1·61	,,	,,	,,	from 5 to 10	,,	,,
0	,,	,,	,,	,, 10 ,, 15	,,	,,
28·22	,,	,,	,,	,, 15 ,, 20	,,	,,
43·55	,,	,,	,,	,, 20 ,, 25	,,	,,
13·71	,,	,,	,,	,, 25 ,, 30	,,	,,
4·03	,,	,,	,,	,, 30 ,, 35	,,	,,
2·42	,,	,,	,,	,, 35 ,, 40	,,	,,
3·22	,,	,,	,,	,, 40 ,, 45	,,	,,
1·61	,,	,,	,,	,, 45 ,, 50	,,	,,
0	,,	,,	,,	over .. 50	,,	,,

On graphical representation these numbers give the curve of fig. 2.

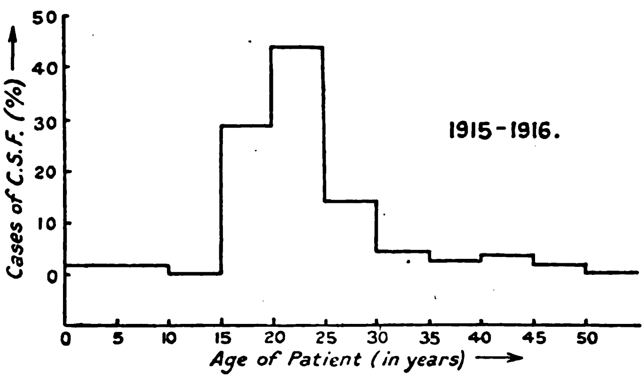

FIG. 2.

This figure shows that the *apparent* most susceptible age is between 20 and 25, in which age-period nearly fifty per cent of the cases occurred. In this particular the finding for 1915-16 confirms that of 1914-15; indeed, the parallelism between the two curves is very striking.

This age, it will be noticed in passing, corresponds to the military age.

In order to get the *real* most susceptible age, and at the same time to generalize the above finding, the percentage number of cases for each age-period requires to be referred to the percentage number of people of that age-period living in the district at the time. To get a rough approximation to the latter, I have taken the combined statistics of the contacts, 914 in number, of the thirty-one cases (1914-15); and the contacts, 2,109 in number, of the sixty-two cases (1915-16)—dealt with by the Laboratory[1]—and arranged them in terms of age-periods. Table I sets out the result :—

[1] Associated as Laboratory Staff with me in connexion with these contact examinations, have been : Acting Serjt. J. W. J. Leighton, B.Sc.(Lond.), R.A.M.C.(T.) ; Cpl. H. L. Smith, R.A.M.C.(T.); Ptes. G. Blunt, T. Dakin and E. Wigg, of the Royal Army Medical Corps.

TABLE I.

Age-period	Number of contacts	Percentage age distribution
Under 5	6	0·20
5 to 10	13	0·43
10 ,, 15	17	0 56
15 ,, 20	614	20·31
20 ,, 25	982	32 48
25 ,, 30	554	18·33
30 ,, 35	325	10·75
35 ,, 40	233	7·71
40 ,, 45	141	4·66
45 ,, 50	85	2·31
Over 50	53	1·75

Now if we arrange the ninety-three cases of the disease to which the above numbers appertain in corresponding age-periods, and refer the percentage number of cases in each age-period to the percentage age distribution of that period we get Table II :—

TABLE II.

Age period	Total number of cases in the district during 1914-15 and 1915-16.	Percentage cases	$\frac{\text{Percentage cases}}{\text{Percentage age distribution}}$	
Under 5	0 + 1 = 1	1·08	$\frac{1\cdot08}{0\cdot20}$	5·40
5 to 10	1 + 1 = 2	2·15	$\frac{2\cdot15}{0\cdot43}$	5·00
10 ,, 15	1·5 + 0 = 1·5	1·61	$\frac{1\cdot61}{0\cdot56}$	2·87
15 ,, 20	7 + 17·5 = 24·5	26·34	$\frac{26\cdot34}{20\cdot31}$	1·30
20 ,, 25	11·5 + 27 = 38·5	41·40	$\frac{41\cdot40}{32\cdot48}$	1·27
25 ,, 30	2 + 8·5 = 10·5	11·29	$\frac{11\cdot29}{18\cdot33}$	0·61
30 ,, 35	3 + 2·5 = 5·5	5·91	$\frac{5\cdot91}{10\cdot75}$	0·55
35 ,, 40	2 + 1·5 = 3·5	3·76	$\frac{3\cdot76}{7\cdot71}$	0·49
40 ,, 45	0·5 + 2 = 2·5	2·69	$\frac{2\cdot69}{4\cdot66}$	0·58
45 ,, 50	1·5 + 1 = 2·5	2·69	$\frac{2\cdot69}{2\cdot81}$	0·95
Over 50	1 + 0 = 1 31 + 62 = 93	1·08 100·0	$\frac{1\cdot08}{1\cdot75}$	0·61

On plotting the ratios of column 4, above table, as ordinates and the corresponding age-periods as abscissæ, we get the curve of fig. 3.

In reckoning the number of individuals occurring in a given age-period those appertaining to the ages which limit the period are counted both ways; e.g., if there were fifteen cases of 20 years of age, 7·5 would be referred to the period 15—20, and 7·5 to the period 20—25. This is the explanation of the decimals in column 2.

A glance at this figure suffices to see that for the present epidemic the *real* most susceptible age is under 5 years, that is, during infancy and early childhood; while there is a marked falling off of cases after adolescence is passed and adult life is reached—indeed, the least susceptible age would appear to be between 35 and 40.

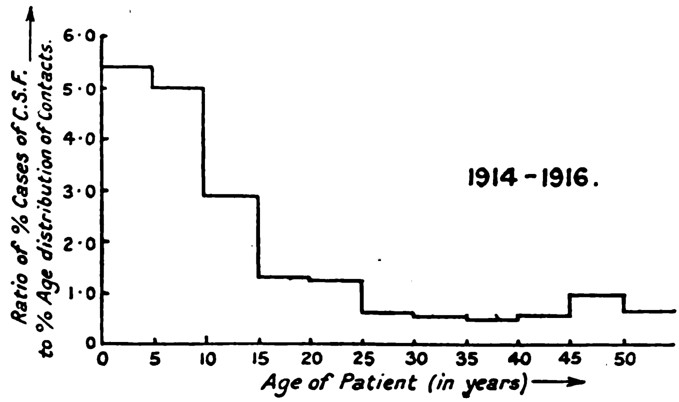

FIG. 3.

It is interesting to note that this result establishes the percentage of the present epidemic with that of former epidemics in this and other countries: children, in other epidemics, according to most observers, having been noted to be most susceptible to the disease.

But, in addition, the result is of interest from the point of view of etiology. My studies in connexion with the disease in the Dorset district during 1914-15 led me to formulate the hypothesis that cerebrospinal meningitis is a weather disease, outbreaks being associated with sudden saturation of the atmosphere by water-vapour, combined with equable conditions of temperature—the meningococcus being about.[1] This hypothesis has been further developed and confirmed by my studies of 1915-16.[2] On this theory the increased facility with which, in the case of the child "carrier," the meningococcus traverses the naso-pharyngeal mucous membrane barrier to enter the system and invade the meninges, can easily be explained by the greater fragility and delicacy of the naso-pharyngeal *mucosa* of the child.

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[1] Report to the War Office, Medical Research Committee, of August 2, 1915 (JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, November, 1915, pp. 546-570; the *Lancet*, 190, 1916, p. 255).

[2] Report to the War Office, of October 16, 1916. (Not yet published.)

Report.

AN INVESTIGATION INTO THE INCIDENCE OF ALBUMINURIA AND CASTS IN BRITISH SOLDIERS DURING TRAINING AND THE RELATIONSHIP OF THIS CONDITION TO WAR NEPHRITIS.

By Captain H. MacLEAN.
Royal Army Medical Corps.

Report to the Committee on War Nephritis.

(The Medical Research Committee provided the services of Captain H. MacLean.)

CONTENTS.

(1) Introduction.

The question of the incidence and significance of albuminuria in the soldier has up to the present received very little attention. A few attempts[1] in this direction have been made, but in each case the number of men examined has been too small to warrant any general application of the results obtained. Further, it does not seem that any attempt was made in these investigations to ensure the collection of specimens under suitable or comparable conditions. As will be shown later, the incidence of albuminuria in a group of soldiers is often increased by as much as 100 per cent or more as the result of a few hours' active exercise, so that a series of examples taken from the same men in the morning and at night would show very marked differences. In any investigation of this kind it is necessary, in order to ensure reliable results, to take the specimens in the morning, as in this case the results are comparable and represent the *minimum incidence* of albuminuria in any group of men at a given time.

The various results obtained in the present investigation are summarized in the following pages. Such an investigation as that here recorded has never before been carried out on anything approaching the present scale, and so great is the wealth of data collected that it is quite impossible to do justice to it at the present time. Only the essential points haviug a direct practical bearing are recorded here, but it is hoped that the great collection of facts which have been accumulated may, in the future, form a subject for the labours of the professional statistician.

In all, 60,000 men were examined. Of these, the first 50,000 were men who

[1] As the present paper was written under circumstances in which it was impossible to consult the literature, no references are given.

had finished their course in England and had come to the base at Etaples for a short period—generally nine or ten days—to complete their training before going to the front. Some of these, of course, had been in the line before, and were returning after being wounded or sick, but these constituted only an insignificant proportion of the total.

The exact period of training which the different individuals had undergone varied greatly, and is set out in tabular form later on; other particulars, such as age, are also furnished.

The last 10,000 men were examined at Aldershot, and chiefly represented recruits who had undergone little or no training.

General Procedure in Collection and Examination of Urine.

For the reason already stated, morning urine alone was examined. In general, the first specimen passed after getting up in the morning was obtained. The difficulties encountered in the various phases of this investigation were often very great; the large scale on which operations were carried out made it exceedingly difficult to get a sufficient number of specimens per day without interfering with the arrangements made for the training of the men. Again, the local conditions for such an examination were by no means ideal, as both materials and laboratory accommodation were of the most primitive kind.

After several unsuccessful attempts, the following routine method for the collection of specimens was adopted; it worked excellently, and was capable of being partly carried out by hospital orderlies.

The urines were collected in properly cleaned "Ideal" milk tins. On the evening previous to the collection of specimens an orderly arranged with the N.C.O.s in charge of the selected group to have the men paraded at an early hour in the morning. The men were asked not to pass water, if possible, until the parade took place. On the same evening each man received a slip which he filled up with certain particulars. At first these slips had to be typed, but later on some printed ones were obtained, a specimen of which is attached here.

Regt. No.	NAME AND RANK	Age	Regiment and Battalion Number	Total Period of Service in Army	Civil Occupation	If ever had			Other Illness
						Scarlet Fever	Gonorrhœa	Syphilis	

For the last 10,000 men examined in France some additional details, such as the length of service abroad, were also obtained.

When the slips were handed round to the men, the N.C.O.s in charge took steps to ascertain that they were properly filled up. On the following morning the men paraded, and each man, on handing up his slip to an orderly, received a numbered tin into which he passed urine. The orderly who gave out the tin marked on the slip the number of the tin which the man had just received. In

this way any particular specimen of urine could be identified, and the collection of 300 specimens only took about fifteen minutes, and did not in any way interfere with the men's programme of training. In general, two groups of 300 men were done each day.

After the parade was over, the orderlies, who had been trained to carry out a preliminary examination of the urine, collected the positive specimens and brought them to the laboratory, where they were further examined. As the orderlies had been specially trained to accept as positive every urine that gave the faintest possible reaction with the test employed, it was generally found that only about fifty per cent of the urines brought back actually contained albumin. This, however, ensured that no positive specimen was missed.

In the laboratory the positive specimens were graded according to the amount of protein present; they were then centrifuged and examined for casts.

Tests used for Protein and Methods of Grading Urines according to Amount of Albumin.

The testing reagent used in this investigation was salicyl-sulphonic acid. Of all the protein tests, this is undoubtedly one of the most reliable and delicate; it is so easily applied that any intelligent orderly can be taught to use it in a very short time, and it gives very accurate results. In the rough preliminary testing, six drops or more of a saturated solution of salicyl-sulphonic acid in distilled water were added to about half an inch of urine in an ordinary test-tube. In urines containing a considerable amount of protein a dense white precipitate was at once formed, but any urine giving the faintest opalescence with the reagent was provisionally taken as positive.

In the laboratory the positive specimens were further examined by means of salicyl-sulphonic acid, and, in cases in which any doubt arose, by heat coagulation and by cold nitric acid as well. A rough estimate of the amount of protein present was made, based on the amount of precipitate obtained with salicyl-sulphonic acid. For convenience in tabulating results, six different grades of albuminuria were recorded as A, B, C, D, N, NN; these letters refer roughly to the quantities of albumin indicated in the table.

TABLE I.

Grade	Rough general description of precipitate as given by salicyl-sulphonic acid	Rough quantitative estimation of amount of protein present
A	Very marked	200 to 300 mg. or more per 100 c.c.
B	Marked	80 to 200 mg. per 100 c.c.
C	Fairly well marked ..	20 to 80 mg. per 100 c.c.
D	Very distinct	5 mg. or less to 20 mg. per 100 c.c.
N	Faint	—
NN ..	Faint trace	—

As no exact quantitative estimations were possible, it is obvious that the above grades of albuminuria are only rough general indications of the amount of protein present. In urines marked A, B, and C, the protein reaction was always well marked, and in D it was always quite distinct, so that a definite positive result

was obtained by the ordinary tests (heat coagulation and cold nitric acid tests) as well as by salicyl-sulphonic acid. Urines of grade N sometimes gave the heat coagulation test directly, but more often after the addition of salt and of a trace of acid in some cases. In grade NN no definite results were generally obtained either on boiling or by the cold nitric acid test, though salicyl-sulphonic acid gave a definite slight opalescence. It is, of course, possible that not all the urines in the lower grades contained true protein; they are indicated here merely as giving results with salicyl-sulphonic acid.

In short, any urine of grades A, B, C, D contained sufficient protein to give a definite well-marked reaction with any of the ordinary protein tests, while grades N and NN did not generally do so unless very carefully examined, and even then, in NN samples, negative results were the rule.

Albuminuria and War Nephritis.

The question of the possible relationship of albuminuria to war nephritis was only one of the many points on which it was hoped to obtain definite information. Various other problems, such as the effect of training, the part played by previous disease, the influence of age, and other factors on albuminuria, were investigated.

If war nephritis as seen on active service were the result of conditions prevailing during training, it was hoped that reliable information on these points would be forthcoming.

War nephritis as commonly seen occurs chiefly in men in the fighting area; though isolated cases have been reported as occurring at the base, and even in England, there is little doubt that the majority of cases are found at the Front. It was not improbable, as held by several authorities interested in the subject, that the acute nephritis seen in the Army was the culminating stage of a pathological process induced by such factors as severe and long-continued exertion or other conditions inseparable from the life of the soldier during training for active service. On this view, it was not unreasonable to assume that some evidence of a gradual deterioration of kidney efficiency might be found in soldiers during training, and an answer to this problem was sought in the results of the investigation described in this paper.

In this investigation over 60,000 men have been examined, and the results emphatically support the view that no definite injury to the kidney is sustained by the soldier as the result of the conditions to which he is necessarily subjected during training.

It is difficult to imagine that the kidneys could be injured by training or other factors without some evidence of this being obtained by examination of the urine. If the conditions under which the soldier is prepared for active service were detrimental to the kidney in any appreciable degree, it is almost certain that some evidence of this would be found, at any rate, during the later stages of training, and that the longer the man was in training, the more marked the evidence would be.

The results obtained all point in the same direction, and unequivocally suggest that the kidney efficiency, as indicated by the ordinary examination for albumin and casts in the urine, is not diminished in any way.

This being so, it is difficult to believe that conditions outside the actual area of active operations can play any appreciable part in the etiology of war nephritis.

In order, however, to ascertain whether the men who suffered from albuminuria at the base were ultimately more liable to attacks of war nephritis after they had gone to the Front, a record of the men examined was kept and filed in a card-index system. Arrangements were also made to have the returns of nephritis from the various hospitals in France compared with this record. In this way any relationship existing between present albuminuria and future acute nephritis could be established.

The returns, so far, have been too few for definite statements; but, as was to be expected, several men who, on examination at the base, gave no indication of albuminuria have subsequently returned suffering from acute nephritis. On the other hand, a certain number of those suffering from albuminuria have also returned with acute nephritis. It is hoped that a sufficient number of records of returned nephritis cases already examined for albumin will be forthcoming within the next few months to form the subject of a special communication.

Meanwhile, the results of the present investigation strongly support the view that the albuminuria of soldiers in active training at the base is not increased by the conditions associated with this training, and was probably present to an equal extent in civil life.

(2) Incidence of Albuminuria in 50,000 Men examined at the Base.

All the men examined were, of course, marked "Active Service," and at the period of examination were undergoing a fairly strenuous course of training. The investigation took place during the summer months; it began about the end of May, and was completed about the beginning of October, 1917.

In certain cases of albuminuria the presence of spermatozoa or pus in the urine indicated at once the probable cause, but it is important to note that in several cases definite epithelial, as well as hyaline, casts were present. It is generally stated that when spermatozoa are found in the urine, certain bodies closely resembling hyaline casts are also met with. As these bodies do not come from the kidneys, they are of no significance, but it is often very difficult to distinguish between such bodies and the delicate clearer variety of hyaline cast. When epithelial casts are present, however, there can never be any doubt as to their origin. In order to make all allowances for complications of this kind, the total number of men suffering from albuminuria of all varieties was ascertained, and the cases showing any possible cause for the presence of the albumin were noted. The examination of the morning specimens of urine certainly suffers from the disadvantage that spermatozoa are fairly common, but as these bodies are easily found on examination with the microscope, the condition does not give rise to any great difficulty.

The men were examined in groups of 10,000; the various results are recorded in the following tables (II to VII), in which the intensity of the albuminuria is also indicated. It will be seen that the comparable figures obtained in the different groups agree remarkably well on the whole.

Roughly speaking, the total percentage of albuminuria unaccounted for by any of the conditions already mentioned (pus, spermatozoa, blood, etc.) was found to be about 5 per cent; of this, only about 2 per cent represented gross albuminuria of the A, B, C, D grades, while the other 3 per cent was of the less marked variety.

The actual figures in the 50,000 men were as follows:—

Total number with albuminuria = 6·48 per cent.

Number with albuminuria after allowing for pus, spermatozoa, etc. = 5·62 per cent.

Number with gross albuminuria (A, B, C, D grades) = 2·55 per cent.

Number with gross albuminuria after allowing for pus, etc. = 2·29 per cent.

Exact details will be found on reference to the tables in which the distribution of albuminuria in the various groups is given.

TABLE II.—Showing Incidence of Albuminuria in each of the Five Groups of 10,000 Men Examined.

Groups of 10,000 men	Percentage of total number with albuminuria	Percentage with albuminuria after allowing for pus, etc.	Percentage with gross albuminuria (A, B, C, D grades)	Percentage with gross albuminuria after allowing for pus, etc.	Percentage with slight albuminuria (N and NN grades)	Percentage with slight albuminuria after allowing for pus, etc.
1st group ..	5·88	5·26	1·80	1·63	4·08	3·63
2nd ,, ..	6·53	5·81	1·77	1·53	4·76	4·28
3rd ,, ..	6·95	5·85	3·02	2·50	3·93	2·35
4th ,, ..	6·27	5·05	2·78	2·23	3·49	2·82
5th ,, ..	6·77	6·16	3·40	3·08	3·37	3·08
Average ..	6·48	5·62	2·55	2·19	3·92	3·23

TABLE III.—Total Albuminuria in First Group of 10,000 Soldiers Examined.

Grade of albuminuria	Total number with albumin	Number showing albumin without known cause	Number in which albumin possibly due to pus, etc.	Total percentage with albumin, irrespective of cause	Percentage showing albumin without known cause	Percentage in which albumin possibly accounted for as due to pus, etc.
A	24	24	—	0·24	0·24	—
B	45	37	8	0·45	0·37	0·08
C	36	34	2	0·36	0·34	0·02
D	75	68	7	0·75	0·68	0·07
N	185	163	22	1·85	1·63	0·22
NN	223	200	23	2·23	2·00	0·23
Total	588	526	62	5·88	5·26	0·62

TABLE IV.—Total Albuminuria in Second Group of 10,000 Soldiers Examined.

Grade of albuminuria	Total number with albumin	Number showing albumin without known cause	Number in which albumin possibly due to pus, etc.	Total percentage with albumin, irrespective of cause	Percentage showing albumin without known cause	Percentage in which albumin possibly accounted for as due to pus, etc.
A	8	8	—	0·08	0·08	—
B	29	23	6	0·29	0·23	0·06
C	27	25	2	0·27	0·25	0·02
D	113	97	16	1·13	0·97	0·16
N	192	166	26	1·92	1·66	0·26
NN	284	262	22	2·84	2·62	0·22
Total	653	581	72	6·53	5·81	0·72

TABLE V.—Total Albuminuria in Third Group of 10,000 Soldiers Examined.

Grade of albuminuria	Total number with albumin	Number showing albumin without known cause	Number in which albumin possibly due to pus, etc.	Total percentage with albumin, irrespective of cause	Percentage showing albumin without known cause	Percentage in which albumin possibly accounted for as due to pus, etc.
A	8	8	—	0·08	0·08	—
B	25	24	1	0·25	0·24	0·01
C	36	36	—	0·36	0·36	—
D	233	182	51	2·33	1·82	0·51
N	213	179	34	2·13	1·79	0·34
NN	180	156	24	1·80	1·56	0·24
Total	695	585	110	6·95	5·85	1·10

TABLE VI.—Total Albuminuria in Fourth Group of 10,000 Soldiers Examined.

Grade of albuminuria	Total number with albumin	Number showing albumin without known cause	Number in which albumin possibly due to pus, etc.	Total percentage with albumin, irrespective of cause	Percentage showing albumin without known cause	Percentage in which albumin possibly accounted for as due to pus, etc.
A	2	2	—	0·02	0·02	—
B	27	24	3	0·27	0·24	0·03
C	35	30	5	0·35	0·30	0·05
D	214	167	47	2·14	1·67	0·47
N	193	151	42	1·93	1·51	0·42
NN	156	131	25	1·56	1·31	0·25
Total	627	505	122	6·27	5·05	1·22

TABLE VII.—Total Albuminuria in Fifth Group of 10,000 Soldiers Examined.

Grade of albuminuria	Total number with albumin	Number showing albumin without known cause	Number in which albumin possibly due to pus, etc.	Total percentage with albumin, irrespective of cause	Percentage showing albumin without known cause	Percentage in which albumin possibly accounted for as due to pus, etc.
A	6	4	2	0·06	0·04	0·02
B	27	27	—	0·27	0·27	—
C	52	51	1	0·52	0·51	0·01
D	255	226	29	2·55	2·26	0·29
N	191	171	20	1·91	1·71	0·20
NN	146	137	9	1·46	1·37	0·09
Total	677	616	61	6·77	6·16	0·61

From the large numbers of men examined, the results obtained as indicated above may be taken as a measure of the incidence of albuminuria in the British Army during training.

Our information regarding the incidence of albuminuria among soldiers in the trenches is very scanty, but a few very interesting observations have been recorded by MacLeod, who gives the following results :—

I.

French troops, examined within twenty-four hours after return from the trenches.

Examined		Albuminuria						Percentage with albumin
		Copious		Distinct		Trace		
1,861 men	..	4	..	16	..	10	..	1·66

II.

British troops, the majority of whom had been in the trenches recently.

Examined		Albuminuria						Percentage with albumin
		Copious		Distinct		Trace		
2,220 men	..	27	..	48	..	30	..	4·73

III.

British troops, who had been some days in the trenches during the coldest weather of the year. Specimens were collected in the trenches. These men had all been in France for twelve months.

Examined		Albuminuria						Percentage with albumin
		Copious		Distinct		Trace		
311 men	..	—	..	4	..	7	..	3·53

Unfortunately, the numbers of men examined by MacLeod were much too small to permit of the comparison of his figures with the results obtained in the present investigation. It is very doubtful whether they furnish any evidence as to the real incidence of albuminuria in the trenches. However, if we accept the figures provisionally, the total percentage of British soldiers suffering from albuminuria in the trenches is 4·6.

As MacLeod gives no information as to the methods he made use of in testing for protein, but describes the amounts of protein obtained as "copious," "distinct," and "trace," it may be assumed that his results compare with those indicated in this investigation from "very marked" to "faint," i.e., the amounts referred to as A, B, C, D, N, while the NN grade may be omitted.

From this point of view, MacLeod's figure of 4·6 per cent of albuminuria in the trenches is greater than the corresponding figure (3·75 per cent) in this investigation. On the other hand, MacLeod's figure is somewhat below the total percentage of albuminuria when urines containing only a very faint reaction with salicyl-sulphonic acid are included. For the 50,000 men this works out at 5·62 per cent.

So far as the figures go, they seem to indicate that the incidence of albuminuria in the trenches does not appreciably differ from that found in soldiers during training.

The percentage of men with "distinct" albuminuria in both investigations is very similar—2·55 per cent in this one (varying from 1·80 to 3·40 per cent in the different groups of 10,000), while in that of MacLeod it is 2·2 per cent.

(3) Presence of Casts in Albuminous Urines.

General Procedure.

All the specimens of urine which contained albumin were examined for casts. About 25 cubic centimetres of urine were centrifuged for a few minutes and the deposit examined under the microscope. As the tins containing the urine had generally stood for several hours before the examination for casts could take place, most of the solid constituents present were by this time in the lower layers of the urine or on the bottom of the vessel. The upper layer of urine was therefore poured off as carefully as possible, and when only about thirty cubic centimetres to forty cubic centimetres remained, this was shaken up and twenty-five cubic centimetres used for centrifuging.

In examining the deposit it was found most convenient to pipette about ½ cubic centimetre of material from the bottom of the centrifuge glass, and to spread this in a thin layer over the greater part of an ordinary microscope slide. It was then examined quickly with a low power. When necessary, for purposes of identification of casts and their structure, higher powers were employed.

Nature of Casts Present.

Almost all the casts found were either epithelial or of hyaline nature; very few blood casts were encountered. The epithelial casts varied much in the stage of degeneration presented by the epithelium, but the majority of them showed the usual appearances seen in acute nephritis, where the outline of the individual cell is often fairly distinct. The hyaline casts also comprised many of the ordinary clear ill-defined variety, but a very considerable number were definitely granular in structure, and might be referred to as hyalo-granular casts. All stages of granularity, from many comparatively large well-marked particles to a very few small ill-defined granules, were observed, but in all such cases the matrix of the cast presented a definite hyaline appearance.

For statistical purposes, the casts were therefore divided roughly into two classes—epithelial and hyaline—and were characterized entirely on the appearance presented by unstained specimens, since the large number of deposits examined did not permit of a more detailed examination.

In the great majority of cases where epithelial casts were present, hyaline casts were found as well, but in many specimens hyaline casts alone were found. While many authorities believe that the presence of epithelial casts—at any rate, in moderately large numbers—is pathological and indicates some definite lesion of the kidney, it is often supposed that the hyaline variety is of little significance. From what we see, however, in the urines of patients who are suffering from acute nephritis, it is certain that the hyaline variety may in many cases be the only casts present. In such patients, even when the disease is well marked, as indicated by the usual symptoms, it often happens that the urine contains only a few small hyaline casts, while in other cases very large numbers of this variety of cast may be present. On the other hand, it may be quite impossible to find epithelial casts.

It might be observed here that with the exception of certain cases of acute nephritis, the epithelial cast is present on the whole in smaller numbers than the hyaline cast. The importance formerly attached to the presence of one or two

epithelial casts in a specimen of urine might have been dependent, to some extent, on the conditions under which their presence was indicated. Not so long ago it was the custom when looking for casts to allow the urine glass to stand for some time, and then to examine the sediment. In this case, however, casts might easily be missed even when present in fair numbers, and when a few were actually found it was almost certain that such a urine really contained a considerable number. Under modern conditions the use of the centrifuge makes it very much easier to isolate casts from urines which contain only a very few, so that the presence of one or two epithelial casts in the deposit from a centrifuged urine gives no indication that many casts are really present, whereas the finding of casts by direct examination generally means that the urine contains considerable numbers. Results obtained by means of the centrifuge cannot therefore be compared with the results obtained by direct examination of the urine.

As will be observed by referring to the tables given later on, the presence of casts was by no means confined to urines exhibiting a high grade of albuminuria, for, in several cases, urines with only a trace of albumin contained large numbers of epithelial casts, while in other cases many hyaline casts were found. Such results are by no means rare in ordinary practice where they are generally associated with a condition of chronic interstitial nephritis. In practically all such cases which the writer has seen in hospital practice, the kidneys were found to be markedly defective as indicated by the diastatic test. In the cases found in soldiers in France, however, the combination of large numbers of casts with mere traces of albumin was not apparently associated with any appreciable degeneration of the renal tissue, for the diastatic reaction was normal in the great majority of the cases in which it was used. The very large numbers of urines dealt with in this investigation precluded the possibility of applying this test to all such urines, but a considerable number were examined. With the exception of a very few cases, the diastatic reaction was between fifteen and twenty-five—figures practically identical with those obtained from normal urine.

It is not improbable that casts may sometimes occur in urines which are free from albumin, but it is certain that this is very rare, for in 100 specimens of normal urine examined no casts of any kind were found. This view is further borne out by the fact that the percentage of urines with a very small amount of protein which contained casts was comparatively small; in this connexion it was observed that urines which gave only an exceedingly faint reaction with salicyl-sulphonic acid (certain of the urines of grade NN) rarely contained casts. In no case were epithelial casts found in such specimens, and in the few cases in which hyaline casts were observed, the number was usually limited to one or two. In order to settle the question definitely it would, of course, be necessary to examine several thousands of protein-free urines, but there was no time for this during the present investigation.

With regard to certain of the urines stated to contain hyaline casts only, it is possible that a few of them might have contained a very small number of epithelial casts as well, but it is certain that this could be the case only in a very few instances, since the examination for casts was carried out very carefully, several specimens of deposit from the same urine being sometimes examined.

Occasionally a few blood casts were found associated with epithelial casts,

but the former were of such infrequent occurrence that no special record of them was kept.

Along with casts several other elements were found in the deposits, but nothing abnormal was observed. The extremely common occurrence of calcium oxalate crystals, which at some periods were present in large amount in almost every urine examined, is perhaps worth noting. No explanation of this phenomenon could be found in the nature of the diet partaken of at the particular period.

General Results Obtained.

For the 50,000 men examined, the average percentage of urines found to contain casts was 1·87; of this number 0·84 per cent had definite epithelial casts, while in 1·03 per cent hyaline casts only were found. The percentage of casts in the various groups of 10,000 men is indicated in the table. It will be seen that the figures in the different groups correspond fairly well.

TABLE VIII.—PERCENTAGE OF CASTS IN FIVE GROUPS OF 10,000 MEN EACH.

	Total percentage with casts	Percentage with epithelial casts	Percentage with hyaline casts
1st group of 10,000 men	1·60	0·75	0·85
2nd ,, ,,	1·52	0·88	0·64
3rd ,, ,,	2·01	1·00	1·01
4th ,, ,,	2·13	0·9	1·23
5th ,, ,,	2·10	0·65	1·45

(*To be continued.*)

Reviews.

THE COMPLETE MEDICAL POCKET FORMULARY. By J. C. Wilson, A.M., Physician to the German Hospital, Philadelphia. Sixth Edition, by C. H. Turner, M.D. Philadelphia: J. B. Lippincott Co. Price 10s. 6d. net.

This classified and indexed list of prescriptions, which has reached its sixth edition, evidently supplies a want felt in America, if not in this country. Details of the prescriptions are given in both imperial and metric systems and a therapeutic classification is adopted. One cannot feel that such lists are of material assistance to the therapeutist and to instance the formulæ advised for hæmaturia, few of these are likely to benefit the patient, while under neuralgia and suppositories prescriptions advising the local application of morphine are retained. Diet tables are given in which one finds beet advised and also disadvised in diabetes. The book is conveniently arranged for reference and handsomely bound, but in our opinion it requires a thorough and very critical revision in the light of modern pharmacology and therapeutics. W. J. D.

SURGICAL THERAPEUTICS AND OPERATIVE TECHNIQUE. By E. Doyen. English Edition by H. Spencer-Browne. Pp. viii + 680. 10¾ × 6½. London: Baillière, Tindall and Cox. 1918. Price 25s. net.

This, the second volume of Doyen's book, is devoted to a description of such operations on the head, neck and extremities as were practised by the late Professor Doyen. It will be perused with interest not only by the general surgeon, but also by the specialist, for Doyen was a very catholic surgeon and

nothing came amiss to him. He describes with equal authority his technique for dental extraction, for amputation, or for the removal of adenoids. The book is written with the directness and simplicity one is accustomed to expect from French authors and it is well printed, well bound, and profusely illustrated.

There is much that is original, but all the methods described appear to have given Professor Doyen good results. He was obviously a master of technique and operated with extreme rapidity. But whether high speed and successful surgery are necessarily synonymous is perhaps open to some doubt.

The value of the book is not perhaps so great as one might expect. All operations therein described sound easy, but there is not enough detail given to satisfy the requirements of the beginner, while surgeons of experience would certainly wish for further information about results before adopting the same methods.

A statement occurs on page 2 to the effect that the author has obtained resolution of phlebitis of the cavernous sinus in many instances by one or two injections of anti-staphylococcic vaccine. It scarcely seems possible that any one surgeon should have seen "many instances" of thrombosis of the cavernous sinus, still less that he should have been able to cure such a deadly disease by one or two injections of vaccine. Later on it is stated, "about the same time I succeeded in obtaining a complete cure of many cases of recurrent sarcoma of the clavicular region by thermo-coagulation." These are not solitary instances of dogmatic statements making claims which seem hardly credible, but they occur throughout the book and seriously invalidate its authority as a trustworthy guide to surgical therapeutics.

Doyen is dead; he was a wonderful operator and had a wonderful belief in himself, in his mycolysin for curing inflammatory lesions, and in his anti-neoplastic vaccine for curing malignant growths. At any rate his manual dexterity was indubitable and he will always go down to fame as the first surgeon to have his operative technique recorded on the cinematographic film. C. R.

A MANUAL OF PHYSICS FOR MEDICAL STUDENTS. By H. C. Candy. Pp. viii + 451. $6\frac{1}{4} \times 3\frac{7}{8}$. London: Cassell and Co., Ltd. Twentieth Edition. 1918. Price 7s. 6d. net.

Three half crowns is not too much to pay for this compendium of physics, which appears to comprise all that is required by the medical student for the purpose of preparing himself for examination.

Part I, "General Physics," is well written and illustrated by numerous figures. The other parts deal with special subjects in a manner usually adequate.

But the student who desires to read Bayliss' "General Principles of Physiology," will need more than this. R. M. S.

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Original Communications.

AN ATTEMPT AT CLASSIFICATION OF *BACILLUS DYSENTERIÆ*, BASED UPON AN EXAMINATION OF THE AGGLUTINATING PROPERTIES OF FIFTY-THREE STRAINS.

BY CAPTAIN E. G. D. MURRAY.
Royal Army Medical Corps.
(*From the Vaccine Department, Royal Army Medical College.*)

CONTENTS.

(1) Introduction.

In view of the importance of the prevention of outbreaks of dysentery in the Expeditionary Forces, Major H. Graeme Gibson published an account of a workable prophylactic dysentery vaccine in the Journal of the Royal Army Medical Corps for June, 1917.

This vaccine consists of a mixture of an emulsion of bacillary bodies and dysentery antitoxin, the latter in the form of an "absorbed" serum, injected at the same time. This has been in use in the field with good results since the date of the above-mentioned publication.[1]

In 1918, Boehncke published an account of a very similar vaccine (Dysbacta-Boehncke) which is at present being extensively used in Germany.

Shiga vaccinated 10,000 Japanese in 1900 with a mixture of dysentery bacilli and anti-dysentery serum, thereby lowering the mortality but failing to reduce the incidence of the disease. In the village of Koai, however, he succeeded in reducing the incidence from twenty-eight per month to nil.

In 1909, Dopter carried out an admirable piece of work on the various methods which might be employed in producing a prophylactic dysentery vaccine. He tried a mixture of serum and virus, but concluded that the evidence afforded by his experiments favoured the Besredka "sensitized" vaccine more than any other.

Gibson's vaccine differs from all the above in that the serum used is first "absorbed" with dysentery bacilli in order to remove the anti-bacterial antibodies before diluting it for use with the bacillary emulsion.

The work contained in this paper was undertaken in June, 1917, and had as its object an endeavour to determine the antigenic types of dysentery bacilli and thus to facilitate the selection of strains for inclusion in the British vaccine and to increase its range and efficiency. Some work commenced at Kasauli in 1916 is also included.

From the point of view of the specific treatment of cases of dysentery this work also has a bearing on the production of therapeutic sera.

The method of differentiating the various members of the dysentery group by their reactions with certain "sugars" has given rise to an increasing number of varieties proportionate to the growing number of fermentable substances employed for the purpose. The list comprises bacilli which it does not seem possible to group together systematically. The extreme variants differ in their behaviour in such essential reactions as Gram staining, motility, fermentation of lactose, the presence or absence of flagella and gas production in "sugar" media. The main characters in which the more typical members of the group differ are concerned with the fermentation of the more or less rare "sugars" and their behaviour towards specific sera.

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[1] Gibson, Journal of the Royal Army Medical Corps, May, 1918.

Some authors have attributed the power of producing the lesions of dysentery to *Bacillus coli*, while others qualify this view by pre-supposing an exaltation of virulence of the latter. Seligmann believes that climatic or other conditions give rise to a "new generation" of infective material, occurring in the "lurking places" of specific bacteria, or in the intestinal flora of normal individuals. He does not believe that an epidemic of dysentery arises from a residuum of a previous epidemic, and he gives a graduated scale of the stages through which a coli-like organism passes until, finally, it becomes a typical "Shiga." This theory arises out of the variability observed by him in bacilli isolated from cases of dysentery as to their fermentative and agglutinative reactions.

Dopter and Vaillard quote a list of authors who ascribe to *B. coli* streptococci, diplococci, etc., a causal rôle in dysentery.

Even when the dysentery group is limited to organisms which are Gram-negative, non-motile and which do not liquefy gelatine, it does not seem possible to correlate the work of the majority of observers. This subject is ably dealt with by Cunningham and King.

Andrews, in a recent paper, says: "The great majority of the organisms which pass as 'atypical' dysentery bacilli fall under three species, which so far as present evidence goes derive their importance from their liability to be confounded with genuine dysentery bacilli." He suggests provisionally naming these "atypical" bacilli *B. ambiguus*, *B. alkalescens*[1], and *B. dispar*. The first resembles "Shiga" but produces indol and has no demonstrable relationship with human disease. The second simulates "Flexner" but ferments dulcite and produces alkali vigorously. It is not pathogenic. The third and last name is suggested to comprise lactose-fermenting organisms of the dysentery group some of which are pathogenic to rabbits. All three of these types of organism agglutinate with Michaelis' acid solutions.

Cunningham and King found that over fifty per cent of their ninety-six strains belonged to the fermentative types corresponding to "Flexner" and "Hiss-Y." Their results are summarized as follows:—

"(*a*) About thirty per cent. of dysentery strains isolated showed variations in their fermentations at some time during the course of a fermentation test of seven days' duration.

"(*b*) The amount of variation observed was considerably increased if the result of a second fermentation test, which took place after the strain had been subcultured some months, was compared with the first, only twelve per cent of strains remaining constant from the first to the last reading of both tests.

"(*c*) The majority of these variations occur soon after the isolation of

---

[1] Ford, W. W., *Journ. Med. Research*, vol. i, 1901, p. 211, and also "Studies from the Rockefeller Inst. Med. Research" (Reprints), vol. ii, 1904, gave the name *B. alkalescens* to a bacillus closely related to *B. enteritidis* (Gaertner).

the organism; as the period of incubation is prolonged and as the strain grows older the fermentation becomes more constant."

The tendency of the variation was mainly towards the "Flexner" and "Hiss-Y" types. It is noteworthy that out of five strains of Type 1 (Shiga) which were subjected to a revision test some months after isolation but two remained classed as "Shigas."

Winter used chemical methods of estimating the changes in the sugar media and states that not only the "pseudo-dysentery" bacilli but true "Shiga-Kruse" also decompose maltose to a considerable extent and lactose to a less extent. As metabolic products CO_2, fatty acids (especially butyric acid) and alcohol are produced. He states that colour changes of litmus media in the determination of the decomposition process are to be used with the utmost caution.

Kuenen, quoting Levy, Kolle and Hetsch in confirmation, sharply differentiates between "Shiga-Kruse" and the mannite-fermenters. A non-mannite fermenting bacillus which ferments maltose and differs from "Shiga" in its agglutination he calls "Van der Bosch"; it shows group-agglutination with "Shiga" and "Y" sera. He considers the sub-varieties of "pseudo-dysentery" bacilli to be of little significance. The lesions caused by "Shiga" and the "pseudo-dysentery" strains are identical; the latter caused twenty-five per cent of deaths due to bacillary dysentery at Deli (Sumatra) in 1913.

Fraser does not consider that the results of fermentation tests with maltose, saccharose, sorbite and dextrin ought to be used for purposes of classification as they are very variable. He does not believe "Flexner," "Y" and "Strong" to be types.

Shiga believes the fermentation of glucose and mannite to be constant, but that of lactose, maltose, saccharose and dextrin to be variable both qualitatively and quantitatively. In his experience fermentation and agglutination tests do not correspond. He differentiates sharply between "Shiga-Kruse" and the mannite fermenters by agglutination and bacteriolysis.

In consulting the writings of numerous authors it became evident that the action of dysentery bacilli upon "sugars" is not sufficiently constant or certain to be used as the determining factor as to what strains should be included in the vaccine, or used for producing agglutinating sera.

Turning now to the subject of agglutination reactions as a means of selecting the strains, no very certain evidence of definite grouping was to be discovered.

Cunningham and King found that forty-five out of ninety-one strains reacted to the end-point of the high-titre sera used, while a further twenty-seven strains were just short of it—a partial reaction being obtained at the end-point. Thus seventy-nine per cent gave an approximately complete reaction. A further eighteen strains agglutinated to half-titre. The non-mannite fermenters agglutinated in high dilutions of "Shiga" serum.

It was shown by Vedder and Duval that there were differences in the

degree of agglutination and that in high dilutions some strains failed to agglutinate in patients' sera or in a serum supplied by Dr. Shiga.

Sternberg groups the dysentery bacilli in the following way:—

(1) Bacilli agreeing culturally with the specific types, but not agglutinated by the specific sera.

(2) Bacilli agglutinating with the specific sera but not conforming to the cultural types.

(3) Bacilli, atypical in both the above respects, but which being the dominant organism must be regarded as the presumable cause of the disease.

He further observes that anti-dysenteric serum (horse) often agglutinates *B. coli*, and that glucose, mannite and litmus whey give constant results with dysentery bacilli.

In the experience of Dopter and Vaillard, the strains of the Vincennes epidemic and those of Shiga, Kruse, Flexner and Pfuhl were not agglutinated by sera of patients in Cochin-China and fourteen other cases from the Far East, but one serum among the latter agglutinated 3 out of 11 of the above strains 1 in 20. The serum of an immunized goat agglutinated all the strains of the Vincennes epidemic.

Leisieur, Pellagot and Jacquet found that sixteen out of thirty-four strains agglutinated with Institute Pasteur specific "Shiga" serum. Some organisms are inagglutinable until some time after isolation. One strain agglutinated equally well with "Shiga" and "Flexner" specific sera, and two other strains were isolated from patients whose sera agglutinated both "Shiga" and "Flexner."

Levaditi and Nicholas state that typical dysentery bacilli produce no change in neutral red and behave typically in the sugar and agglutination reactions. Those fluorescing neutral red give anomalous "sugars" and are not agglutinated by the sera of patients from whom they are isolated nor the sera of other patients. Since the "pseudo-dysentery" bacilli often agglutinate quite well with the test sera they conclude that agglutination with specific high-titre sera is not sufficient evidence to identify them as dysentery bacilli.

Martin and Williams are of opinion that no one serum is adequate for the recognition of the mannite-fermenting group. Sera of Kruse's "A" "D" and "E" would embrace all the German strains. "Y" serum seems to be the least specific and "covers the greatest ground." Twelve out of seventy-six of the mannite-fermenting organisms isolated in Egypt in 1916 were not agglutinated by "Y" serum with a titre of 1 in 4,000; on retesting eight of these six months later, four agglutinated between 1 in 400 and 1 in 1,600. Two of the strains not agglutinating after six months subculture, and two of the others which were inagglutinable at first, were tested against the patient's sera in a dilution of 1 in 200 with positive results. These authors also remark that among mannite fermenters are comprised strains distinguishable by the "absorption" test, but which "overlap" by agglutination.

Hehewerth examined thirty strains of "non-toxic" *B. dysenteriæ* and found that his strains could not all be put into one agglutinating group. The fermentation types were inconstant and did not conform to specific agglutination. He advises polyvalent sera for the agglutination test. Castellani's "absorption" reaction in his hands did not give results allowing of a differentiation which would harmonize the results of the two tests.

Morgan found great differences between various recognized strains in their reaction to high-titre sera. He could not confirm by agglutination the grouping arrived at by means of the "sugars." With the "absorption" reaction the various strains showed approximation in some cases but wide differences in others.

Duenna and Lauber observed that strains of the "Flexner-Y" group which agglutinate readily with one serum are most refractory with other sera. They comment upon the varying agglutinability of different strains.

Lancelin and Rideau tested seventy-three strains of dysentery bacilli:—

Forty-six "Flexners" agglutinated with Institute Pasteur "Flexner" serum 1 in 4,000 to 1 in 6,000.

Twelve "Shigas" agglutinated with Institute Pasteur "Shiga" serum 1 in 3,000 to 1 in 6,000.

Four "Para-Flexner" agglutinated with an experimental "Flexner" serum 1 in 2,000 to 1 in 4,000.

Eleven "Para-dysentery" failed to agglutinate with Institute Pasteur "Shiga" serum.

"Para-Flexner" only differed from "Flexner" in that it did not ferment saccharose.

The "para-dysentery" were at first classed with the "Shigas," but were eventually separated from this group as they failed to agglutinate with "Shiga" serum. They are more toxic to rabbits than "Shiga," and likewise fail to produce indol.

None of Lancelin and Rideau's strains ferment dextrose.

Out of 138 sera of patients examined, nine agglutinated "Shiga" only, sixty-seven "Flexner" only, fifteen agglutinated "Shiga" with high group-agglutination for "Flexner." Six cases from which "Flexner" was isolated agglutinated "Shiga" and "Flexner" in high dilutions, while forty-one failed to agglutinate either type. Unfortunately, the "para-dysentery" class was not recognized until it was too late to be able to test them with the sera of the patients from whom they were isolated.

Nolf, Collard, Duliere and Roskam isolated 43 strains of dysentery bacilli of which 13 "Flexner" and 1 "Shiga" were typical. Fifteen were considered allied to "Flexner" and fourteen to "Shiga," except as regards agglutination. Ten were unlike both "Shiga" and "Flexner" in sugars and agglutination. Out of 1,944 positive sero-diagnoses 12 agglutinated exclusively with "Shiga," 991 with "Flexner" or "Y" or both, and 41 with "Shiga," "Flexner" and "Y."

Flexner quotes Gay, who found that "Shiga" and "Flexner Harris" bacilli were differentiated by bacteriolysis *in vivo* with specific sera.

Ohno considers that the action of dysentery bacilli on mannite as a means of subdividing them into groups does not correspond to the grouping obtained by agglutinating sera, and that it is incorrect to make a distinction between "acid" and "non-acid" strains. He includes lactose-fermenters in his dysentery group. It is interesting to note that in his Tables IV, V and VI, there is quite a marked distinction between the "acid" and "non-acid" sub-groups, and even in Table VII, upon which he mainly bases his conclusions, if the rabbit sera only are considered, there is quite a noticeable distinction between the two classes. There is considerable group-agglutination, but it must be borne in mind that in immunizing his animals a very small subcutaneous dose was given and complete recovery allowed to take place before giving the second and increased dose: thus the period of immunization was probably unduly prolonged. Also, he used two or three strains of the same "sugar" group to immunize his animals. He found that bactericidal reactions failed to distinguish between the "Shiga," "Flexner-Y" and other members of the dysentery group. A large number of strains were used by this observer.

Fletcher found that the mannite-fermenting strains isolated by him gave atypical agglutinations tending towards those of the "Y" type. On the other hand, only one strain absorbed the agglutinin from "Y" serum, and none absorbed the agglutinin from "Flexner" serum.

Kruse considers the "sugar" reactions of dysentery bacilli to be of doubtful specific importance. According to him "true dysentery" and "pseudo-dysentery" bacilli have an obvious phylogenetic relationship. "True dysentery" is an united and sharply-defined species, the mannite and indol tests are always negative, and they are agglutinated feebly or not at all by the "pseudo-dysentery" sera. The "pseudo-dysentery" strains are even less agglutinable by "true dysentery" sera. This relationship is also borne out by bactericidal reactions, and immunity is conferred only for the type of bacillus used. It is possible that there are races of "true dysentery" bacilli, but none have been revealed in examining many strains from all parts of the world. From an investigation of fifty strains of "pseudo-dysentery" bacilli, he concludes that agglutination is the best test. According to him the indol test is of no value. He prepared agglutinating sera from all the strains, and by agglutination and "absorption" reactions he divides them into eight races (A to H).

Type A.—The first chief race. Agglutinated by almost every type of serum very highly. Serum A agglutinates B just as well as A, and frequently agglutinates C, D and E very highly and the rest of the types not at all. A "absorbs" B agglutinins and partly "absorbs" C agglutinins." It is the most commonly-occurring German strain. Lactose, maltose and sacchorose are not fermented.

Type B.—(Three strains) does not "absorb" A agglutinins. A and B are

indistinguishable by bactericidal reactions. They differ from A culturally by fermenting maltose, but all the B strains examined differed from one another culturally. They came from Flexner. ("Flexner Harris," "Flexner Manilla," "Flexner America.")

Type C.—(Two strains) serologically identical and not able to "absorb" any other sera. One fermented maltose and the other failed to do so.

Type D.—Second chief race (fifteen strains). More or less strongly agglutinated by sera A, B and C, and weakly by the other sera. Serum D agglutinates A and B highly and the others slightly. Reciprocal absorption with the other types is negative.

Although A and D affect each other strongly in bactericidal reactions, immunity only exists for the homologous strain. Two of this type fermented maltose. He thinks that "Hiss-Y" may belong to this type.

Type E.—When freshly isolated, is strongly agglutinated by A, B and C sera, and conversely E serum affects A, B and C, though more irregularly. Reciprocal absorption does not occur. Active immunity for A, D or E is only conferred for the respective type. Type E was isolated from four sporadic cases in three different Rhine country towns. Lactose and maltose are acidified and milk is clotted in eight to fourteen days.

Types F, G and H comprise three strains which not only do not fall into any of the above types but which differ also among themselves. ("Strong" Manilla and two strains from Von Deycke at Constantinople). Two are strongly agglutinated by sera A and E. One ("Strong") did not agglutinate at all with these sera but shows its relationship to the "pseudo-dysenteries" by the fact that its serum agglutinates the other types, especially A and B. Lactose, maltose and saccharose are variously affected.

The types A and D have been found so often and with the same permanent properties that there is no doubt as to their constancy and pathogenicity. They agglutinate with the patient's sera and a laboratory infection has recently been observed with one of them. The other bacilli, especially those found only once, must therefore be regarded as excitors of the disease by analogy only, and in their case further observation is necessary.

Hutt discusses the results of examining over a hundred strains of "pseudo-dysentery" bacilli and considers it justifiable to consider them as one group. He divides them into eight sub-orders or races by agglutination and absorption tests (A-H).[1] Races B, C and F were only found associated with other races and therefore he calls them secondary. Race E (=Kruse E) is the only one which forms acid, though slowly, in lactose, and therefore it clots milk in from fourteen to twenty-six days. The E are the only strains which agglutinate with E sera, and Hutt considers this race to be a primary cause of dysentery. He includes strains from the Berlin epidemic, and also six strains isolated and described by Berthlein.

[1] This is Kruse's classification.

Berthlein investigated an epidemic of sixty cases, at first severe but later of milder type (chiefly diarrhœa). From four of the early cases he isolated a dysentery-like bacillus of the mannite-fermenting group, not forming indol. Serologically, the strains of this bacillus differed from all other types of dysentery bacilli, but agglutination showed them to belong to one type. Small doses of living culture killed rabbits, guinea-pigs, mice, etc., as also did killed cultures. Two similar strains were isolated from later cases. He lays some stress on difference of shape of colonies to be seen when the strains are plated out. (These strains were among those examined by Hutt, who classes them with Kruse's Group E.)

Dorendorf and Kolle recognize "Shiga" as a cause of dysentery, but thinks the mannite-fermenting bacilli are symbiotic or even merely saprophytic, living on the mucous membrane which has been altered by some cause of dysentery still unknown.

Dopter showed that the Bordet-Gengou reaction fails to distinguish between the various types of *B. dysenteriæ*, both in the case of serum from immunized animals and from patients. When, however, such serum is tested by agglutination it may show well-marked selective properties. Some strains of *B. coli* will also fix the complement to a less degree, but the control, though never positive with *B. dysenteriæ*, is sometimes so with *B. coli*.

Schmitz investigated an epidemic of dysentery among Roumanian prisoners of war. It was typically a contact epidemic occurring during the months of January and February (1916).

The unfavourable conditions of food, the extremely unsanitary condition of the prisoners, insufficient heating arrangements or other protection from climatic conditions during a very severe winter enabled the epidemic to spread at this unusual time of year. There were 815 cases, of which 104 showed typical dysenteric stools, while the rest had more or less severe diarrhœa with or without traces of blood and mucus. The duration of the attack was ten to fourteen days, and it required six weeks before recovery was complete. Of 104 cases, 5 died of dysentery, and 58 others out of the original 815 cases died of pneumonia. From the earliest part and throughout the epidemic, bacilli of the dysentery group were recovered from the stools of the patients. It was only possible to investigate 79 patients, but they were examined very thoroughly. As many colonies as possible were picked off from each plate. Bacilli which could be pronounced dysentery bacilli were found in 22 patients, and these were only to be found in the typical blood and mucus stools. Stools which were merely watery were negative. Twelve plates gave 138 colonies, of which 61 proved to be dysentery bacilli, and out of 38 sub-cultures from 9 plates 22 were dysentery bacilli (57·89 per cent). Out of another 39 cases the bacillus was found in 19; the stools of the rest were fæcal. The type of bacillus differed from the recognized members of the dysentery group in the following ways:—

(*a*) *Culturally:* (1) From the group of "pseudo-dysentery" bacilli by not decomposing mannite.

(2) From "Shiga-Kruse" by abundant indol formation.

(*b*) *Serologically:* (1) No pseudo-dysentery serum agglutinated the "Schmitz" type; nor did the serum produced by the "Schmitz" strains agglutinate any single "pseudo-dysentery" strain. Absorption tests bore out this difference.

(2) The same difference existed between the "Schmitz" strains and "Shiga-Kruse" as between the "Schmitz" strains and "pseudo-dysentery" strains.

(3) The "Schmitz" strains agglutinated in high dilutions and absorbed the agglutinins from any "Schmitz" strains serum.

In one case only (6877) was any other type of dysentery bacillus found; this proved to be a "Y."

"The bacillus of this epidemic, which is to be called 'Schmitz,' thus takes a midway position between the hitherto known groups of dysentery bacilli. It belongs to a new group of which there may perhaps be other representatives."

That this organism is to be regarded as the causal agent of the epidemic is evidenced by the fact that it was only found in the sanguino-purulent portions of the fæces, where it alone occurred, and further that the sera of a series of patients agglutinated this bacillus in high dilutions.

That it belongs to the dysentery group is proved by the character of the epidemic; the coagglutination in Widal tests with "Shiga-Kruse," though in low dilutions; its non-motility and freedom from flagella; the typical dysentery odour of the culture and the characteristic dysenteric lesions as found in autopsies. It does not produce any change in neutral red agar.

In his second paper Schmitz concludes, on the evidence of agglutination and absorption reactions, that the pseudo-dysenterics are all recognizable by their close serological association, though the relationship of the individual strains to one another is very variable.

The following conclusions can be drawn from the literature cited:—

(1) That the evidence of complement fixation tests, and probably the bactericidal reaction, is such as to warrant the "acid" and "non-acid" dysentery bacilli being considered as belonging to the same genus.

(2) That *B. dysenteriæ* "Shiga" forms a well-defined species within this genus with the possibility that the "para-dysentery" group of Lancelin and Rideau form a closely-related variety.

(3) That the *B. dysenteriæ* "Schmitz" [1] forms another distinct species of

[1] A recent paper by Lampl (Wien. Klin. Woch, July 25th, 1918) confirms Schmitz's work in a small but striking way.

the true dysentery genus, distinguishable from "Shiga" by agglutination and "absorption" reactions and by the fact that it produces indol. That this bacillus is probaby identical with Andrew's *B ambiguus* seems evident, and therefore Michaelis's acid agglutination is of no value in distinguishing pathogenic from non-pathogenic dysentery bacilli.

(4) That the mannite fermenters are quite distinct from the non-mannite fermenting group. That they vary very considerably among themselves in their antigenic properties, though probably the differences are not wide enough to classify them as different species.

(5) That the splitting up of the acid group of bacilli by their action on "sugars," besides being in itself unsatisfactory, is no guide to their immunological differences.

(6) That as many authors have described lactose-fermenting members of the dysentery group in connexion with cases of dysentery, the strains included in Kruse's Group "E" deserve further attention in order to define their prevalence and pathogenicity.

(Kruse, Hutt, or Berthlein do not doubt the importance of this group as a cause of dysentery.)

PART I.

Sources and General Character of Strains.

(a) *Sources of Strains.*

I am indebted to:—

Colonel Ledingham, for "Shiga Ledingham," "Flexner Ledingham" and "Y Ledingham" which he gave to me as typical examples of their class, presumably from Egypt, when he came out to Mesopotamia in September, 1916.

Colonel Dudgeon, for "Logan," 6066, 6067, 1210, 6091, 1609, 1460 and Gallipoli, brought by him from Salonica and Gallipoli. He notes that strain 6091 was not agglutinable to the same degree as the others.

Major F. W. Andrews, F.R.S., for five strains:—

Oxford "Y"[1] (from the Pasteur Institute, Paris). (Possibly the true type "Y".)
Oxford "Flexner." (The true type Flexner.)
Whittington.
Mountain. (No. 2464.)
Hughes.

Major J. Cunningham, I.M.S., of the Central Research Institute of

[1] Major F. W. Andrews, F.R.S., tells me that the Oxford "Y" proves quite different from the historical Hiss and Russel "Y" obtained by him from Washington.

India (Kasauli), who kindly obtained the following strains from Dr. Kesava Pai, at Madras :—

"Flexner Pai" Mahamid Ali Karim Khan Rama Cooly Sada Gopall Chuna Famlia	136A Dys. M +

Professor Dean, for sending me his strains "Dean" I and "Dean" II.

Captain Perry, R.A.M.C., who sent me three strains from France: PB 23, PB 24 and PB 27.

Captain Broughton Alcock, for two strains which he brought from Malta, DJ and Blood. The latter was isolated by blood-culture from a case of Shiga's dysentery.

The strains "Shiga" Lister, "Flexner" Lister,[1] and "Y" Lister came from the Lister Institute.

The following strains were among the "stock" cultures at the Royal Army Medical College, and their origin is either from France or Flanders: Hagen, Haines, 6, 7, 13, Maltos, Humphries, Marginson, Ogg, Constance, Toner, Sincos and Fletcher.

The strain Wainwright was sent from Egypt.

Strains Whitby and Harrison are of unknown origin.

When in Mesopotamia I isolated the strains 19A, 34A, 67B, 86A and 104C from acute cases of dysentery. Unfortunately, my notes and some other strains were lost when I was invalided back to India with dysentery in October, 1916. Strain 104 originates from myself.

(b) *Characters of the Strains.*

The fifty-three strains examined fall into four classes, as shown in the following table :—

TABLE I.

	Glucose	Lactose	Mannite	Dulcite	Motility*	Litmus milk
Class 1 ..	A	0	0	0	0	A→K
Class 2 ..	A	0	0	0	0	A→K
Class 3 ..	A	0	A	0	0	A→K
Class 4 ..	A	Irregular; late A	A	0	0	A→K→A Sometimes late clot

A = Acid only
0 = No change
K = Alkaline
(After fourteen days' incubation at 37° C.)

* In hanging drop from four to six hours' broth culture.

[1] In Glyn's paper this strain is called "Millbank Flexner."

Classes 1 and 2 are separated for purposes of description later as to indol production, acid agglutination, specific agglutination and "absorption" reactions.

The existence of Class 4 is explained by the fact that:—

(A) "Flexner" "Ledingham" was given to me by Colonel Ledingham as being a typical "Flexner" strain.

(B) "Y"-Lister is the Lister Institute typical "Y" strain.

(C) All the strains in this class have at one time been included in Class 3 because at first they failed to ferment lactose in fourteen days, but it was noticed later that they possess the property of acting on this sugar. This property varies in the different strains and in the same strain at different times; two days is the shortest time in which the change has been observed to take place, and quite often there has been no change until well into the second week of incubation. From time to time one or other of the Class 4 strains fails to ferment lactose even in twenty-one days, though there has been profuse growth. Sometimes the change is very gradual. A second acidity in milk is sometimes produced, often resulting in the clotting of the milk after prolonged incubation. (Many strains of Class 3 have been observed to produce a second acidity in milk but not so readily as Class 4.) None of these strains have ever been grown and subcultured from a lactose medium except presumably on primary isolation in common with all the other strains. (They have been under observation for periods varying from one to two years.)

(D) Class 4 is probably identical with Kruse E.

The distribution of the various strains in the four classes is shown in the Table II.

TABLE II.

Class 1 ..	"Shiga Ledingham," "104c," "Blood," "Shiga Lister," "Hagen," "Wainwright," "S 7," "Dean 1," "Dean 2."
Class 2 ..	"Haines," "6," "13," "Whitby," "Fletcher," "Harrison."
Class 3 ..	"Y Ledingham," "34A," "Flexner Lister," "Maltos," "Humphries," "Marginson," "Ogg," "Constance," "Toner," "Sincos," "DJ," "PB23," "PB24," "PB27," "Logan," "1609," "6066," "6067," "1210," "6091," "1460," "Gallipoli," "Oxford Y," "Oxford Flexner," "Whittington," "Mountain," "Hughes," "Flexner Pai," "Mahamid Ali," "Karim Kahn," "Sada Gopall," "Chuna Famlia," "Rama Cooly."
Class 4 ..	"Flexner Ledingham," "Y Lister," "19A," "67B," "86A."

(c) *Indol Formation.*

The paradimethylamidobenzaldehyde of Ehrlich being unavailable, the nitroso-indol reaction was employed.

The technique adopted was as described by Gordon in his translation of Abel's "Laboratory Handbook of Bacteriology." Five cubic centimetres of a one per cent solution of peptone (Witte) was inoculated from a single

colony of the strain to be tested and incubated at 37° C. for seven days. One cubic centimetre of a twenty-five per cent solution of sulphuric acid in distilled water was then added, after which one cubic centimetre of a freshly prepared solution of sodium nitrite in distilled water was floated on the top.

A red ring at the junction of the fluids within five minutes indicates the formation of indol. (Note.—The tests were read again after standing for five hours, and there was no change in the results.)

The formation of indol in the mannite fermenters varied with the strain and bore no relationship to the serological types. The reaction will not be further considered in connexion with them except to note that, in the few strains so tested, no relationship was observed between the fermentation of dextrin and the formation of indol as noted by Cunningham and King in the majority of their strains.

The special interest of the reaction is in relation to the non-mannite fermenters. In this group there is a definite relationship between the indol test and the absorption of agglutinins from specific serum.

All the strains of Class 1 were negative as regards indol, whereas all those of Class 2 were positive.

(d) *Michaelis's Acid Agglutination.*

Michaelis states that dysentery bacilli are not agglutinated by the acid solutions described by him, even in the presence of albumin in the form of a trace of normal serum. *B. typhosus* and *B. paratyphosus* A and B and rarely aberrant forms of coli are agglutinated even in the absence of albumin. *B. dysenteriæ* is differentiated from *B. coli* in that the latter agglutinates in the acid solutions in the presence of albumin.

Michaelis's solutions are made as follows :—

	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
Normal NaHO	5 c.c.	5 c.c.	5 c.c.	5 c.c.	5 c.c.	5 c.c.
Normal acetic acid ..	7 ,,	10 ,,	15 ,,	25 ,,	45 ,,	85 ,,

Sufficient distilled water is added to each to bring it up to 100 c.c.

Technique of the Reaction.—An abundant twenty-four hour agar culture is suspended in twenty cubic centimetres of distilled water; in each of six tubes is placed three parts of this suspension with one part of the above solution of acid, the latter being added to its respective tube together with a trace of normal serum. (One drop of a 1 in 10 dilution of normal rabbit serum was used in these experiments.) The contents of the tubes are then well mixed and left undisturbed at 37° C. for two hours, after which time they are read off. Only agglutination visible to the naked eye is considered positive.

All the strains of Class 2 are positive to the test. Of Class 4, Flexner, Ledingham and 86A were also positive. The optimum in each positive reaction occurred in tube 6, and most of them agglutinated to a less degree in tube 5.

The following strains, observed after two hours, showed agglutination visible only by the aid of a lens, but on keeping them for about five hours at laboratory temperature showed flocculation clearly visible to the naked eye:—

Class 4 strains, 19A and 67B.

Class 3 strains, Oxford Y and Hughes.

Class 1 strains, Shiga "Ledingham," Shiga Lister and Shiga 7.

The typhoid strain "Eyre" (which is used for agglutination at the Royal Army Medical College) showed no agglutination visible to the naked eye, though there was lens-visible agglutination in tubes 5 and 6.

One strain which, as it ferments dulcite, is not included in the list of strains used in this work, was also negative to Michaelis's reaction.

With regard to the validity of the test, Andrews came to the conclusion that though the test is an empirical one it seems likely to be of much service, though failure to agglutinate does not prove an organism to be true dysentery. He also noticed granulation visible with a lens in "one or two" true "Shigas." One Flexner Y, even after plating out the strain and selecting two single colonies, showed feeble agglutination visible to the naked eye.

Patrick applied Michaelis's test to forty-five strains of typhoid, and, though he does not doubt the constancy of the results with a given strain, he found the optimum as described by Michaelis to be given by twenty-three strains only. Eight strains failed to agglutinate. Nine gave paratyphoid reactions. The maximum was independent of the time of isolation of the strain. He concluded from his results that the test is of interest rather than of value in the examination of typhoid.

Rost (quoted by Patrick) concluded from an examination of eight strains that the method is a valuable addition to our resources for diagnosing typhoid.

Jaffe (also quoted by Patrick) tested 41 strains of *B. coli*, 40 strains of *B. typhosus*, 11 of *paratyphosus* A, 3 of *paratyphosus* B and 3 of *B. typhi murium* with unsatisfactory results.

(*To be continued.*)

THE PROPHYLAXIS OF MALARIA.

By Colonel G. T. RAWNSLEY, C.B., C.M.G.
Lieutenant-Colonel R. A. CUNNINGHAM.
Royal Army Medical Corps.
AND
Captain J. WARNOCK.
Royal Army Medical Corps.

(Concluded from p. 75.)

(A) Outline and Result of Treatment.

The results of the preliminary observations on the intensive treatment of malaria by large doses of quinine were published in the Journal of the Royal Army Medical Corps for the month of July. The improvement in the state of health of the men who underwent this course justified the decision to place the whole of the — — Corps during the winter months of 1917-18 on antimalarial treatment, employing a similar dosage, but the duration thereof was reduced from twenty-eight to twenty-four days; this was spread over practically the whole winter months, as the bulk of the troops were treated during the periods when they were out of the line in reserve areas; fifteen grains of quinine sulphate were given morning and evening in combination with arsenic, a typical prescription being :—

℞	Quin. sulph.	..	..	..	15 gr.
	Acid. sulph. pur.	..	..	..	$1\frac{1}{4}$ min.
	Spts. chloroform	..	..	..	$1\frac{1}{8}$,,
	Spts. vini rect.	..	..	..	$1\frac{1}{8}$,,
	Liq. arsenici hydrochlor.		..	..	2 ,,
	Sacch. ust.	..	..	..	11 ,,
	Ol. menth. pip.	..	..	..	$\frac{1}{30}$,,
	Aquæ	..	..	..	ad 1 oz. p.

In some cases arsenic was omitted from the mixture and given in the form of iron and arsenic tabloids; one, morning and evening. The composition of the tabloid was :—

℞	Ferri hypophos.	..	..	..	2 gr.
	Quin. bisulph.	..	..	..	1 ,,
	Acid. arsenious	..	..	..	$\frac{1}{50}$,,
	Strychnin sulph.	..	..	..	$\frac{1}{50}$,,
	Saccharin ..	..	..	..	$\frac{1}{100}$,,

For many reasons it was thought advisable to try and disguise the taste of quinine (so that the men should not know they were taking this drug), and the mixture was always alluded to as "the antimalarial tonic."

The course was voluntary, the total numbers treated were 38,433, of whom 23,071, or sixty per cent, were known to have had malaria, but

the numbers infected were undoubtedly higher; about fourteen per cent of the then strength did not undergo treatment.

Relapses occurred in the following proportions:—

	Numbers	Percentage of infected	Percentage of strength
(*a*) During period of treatment	424 ..	1·83 ..	1·10
(*b*) During first month after treatment ..	1,695 ..	7·34 ..	4·41
(*c*) During second month after treatment ..	2,750 ..	11·91 ..	7·15
Totals ..	4,869	21·08	12·66

It was noticed that men who got all their nights in bed suffered very little from relapse (mosquitoes were absent at this time); another class who were singularly free from both primary and recurrent malarial attacks were the older men, illustrative of this statement being a brigade of another corps consisting of old soldiers who have suffered very little from malaria during the whole period of its stay in Macedonia.

From a perusal of these facts it is apparent that complete sterilization of the blood, even by such a course of intensive treatment with quinine, cannot be claimed to be a complete success; efficient measures were taken to ensure that the treatment was thorough and dosage not missed, but apart from this the troops were only too keen and anxious to be cured, and it is certain faulty administration played no part in the results. Quinine therefore must be considered to have no permanent power of sterilization, as it is not thought larger doses could be given with safety, at any rate to troops in the field; the drug undoubtedly kills off large numbers of the young ring forms, and either in this way or by its tonic action or both combined raises the hæmoglobin index of the blood when given in intensive doses.

It may be of interest to record the fact that in forty recent post-mortem examinations made by Captain Warnock, R.A.M.C., malarial pigment was found in both spleen and marrow bone, sections of which were laboriously examined microscopically, both by this officer and other bacteriologists, with the result that only a single parasite (a crescent) was found in the spleen of one case, also that in blood films taken from many men who had suffered from malaria but not of very recent date, it was rare to find the parasite.

The general opinion of medical officers regarding this course of intensive treatment is that although complete sterilization has not been obtained yet the tonic effects thereof have been most beneficial, that the general state of health has been vastly improved and many men kept in the field who would otherwise have been admitted to hospital or found unfit for duty for varying periods; it has also been observed that relapses are far less severe, the duration, in a very large proportion of cases, of each attack only a day, and readily yielding to further quinine and antipyretic treatment.

(B) Statistics of Sickness and Malaria.

For various reasons the whole strength of the corps could not be placed under treatment, so the statistics of sickness as a whole are not

based on the strength who underwent treatment, nor are the admissions for malaria in this table. The average daily sick rates from December to May are:—

1917.			1918.	
December (1916)	0·18 per cent.		December (1917)	0·18 per cent.
January	0·16 ,,		January	0·16 ,,
February	0·20 ,,		February	0·22 ,,
March	0·25 ,,		March	0·26 ,,
April	0·19 ,,		April	0·25 ,,
May	0·24 ,,		May	0·25 ,,

In 1916 and 1917 sick were largely evacuated to Malta and so there were fewer admissions for relapses; in 1917-18 sick were kept at Salonica, and the percentage of men infected by the malarial parasite was far higher. The incidence of malaria was:—

Period November 4, 1916, *to June* 2, 1917.

	1916.		
Week ending	November	4	320
,, ,,	,,	11	250
,, ,,	,,	18	166
,, ,,	,,	25	164
,, ,,	December	2	134
,, ,,	,,	9	92
,, ,,	,,	16	103
,, ,,	,,	23	81
,, ,,	,,	30	68
	1917.		
,, ,,	January	6	48
,, ,,	,,	13	53
,, ,,	,,	20	83
,, ,,	,,	27	83
,, ,,	February	3	105
,, ,,	,,	10	84
,, ,,	,,	17	73
,, ,,	,,	24	122
,, ,,	March	3	115
,, ,,	,,	10	123
,, ,,	,,	17	143
,, ,,	,,	24	205
,, ,,	,,	31	205
,, ,,	April	7	188
,, ,,	,,	14	168
,, ,,	,,	21	244
,, ,,	,,	28	236
,, ,,	May	5	303
,, ,,	,,	12	248
,, ,,	,,	19	338
,, ,,	,,	26	280
,, ,,	June	2	233
		Total	5,058

Period November 3, 1917, *to June* 1, 1918.

	1917.		
Week ending	November	3	992
,, ,,	,,	10	683
,, ,,	,,	17	510
,, ,,	,,	24	411
,, ,,	December	1	505
,, ,,	,,	8	294
,, ,,	,,	15	211
,, ,,	,,	22	244
,, ,,	,,	29	120
	1918.		
,, ,,	January	5	125
,, ,,	,,	12	124
,, ,,	,,	19	102
,, ,,	,,	26	102
,, ,,	February	2	79
,, ,,	,,	9	97
,, ,,	,,	16	231
,, ,,	,,	23	283
,, ,,	March	2	371
,, ,,	,,	9	310
,, ,,	,,	16	385
,, ,,	,,	23	394
,, ,,	,,	30	470
,, ,,	April	6	568
,, ,,	,,	13	375
,, ,,	,,	20	297
,, ,,	,,	27	276
,, ,,	May	4	326
,, ,,	,,	11	346
,, ,,	,,	18	403
,, ,,	,,	25	353
,, ,,	June	1	359
		Total	10,346

(c) The Effect of Hot and Cold Weather on Malaria.

From a study of these admission rates it will be seen there is a decline in the admission rate for malaria in the winter months; this relation of heat and cold appears constant, and to have an important bearing on the incidence of relapses amongst men infected by the malarial parasite.

Surely we ought to expect more relapses in December, January and February than in March, April and May, the original infections being of more recent occurrence; fresh sources of primary infection being absent. This year at least sixty per cent of — — Corps were known to be affected, and yet relapses in December, January, and up to the middle of February are low, but from then onwards with the increase of the temperature of the air the admission rate becomes higher. In the month of January, both in 1917 and 1918, anopheline larvæ were found but no pupæ; this year very few anopheline larvæ were found in the *traps*, and none earlier than the middle of May. Last year it was considered primary infections began about June 12, which the observations as regards larvæ will undoubtedly confirm for this year; the only mosquitoes in the earlier months are hibernating and inactive. These facts therefore prove that the cases which occur at this period of the year are due to relapse. There is therefore a period of natural decline of recurrent malaria corresponding to the cold weather, and which is quite independent of quinine administration, as in the winter of 1916-17 in the absence of such treatment the same fall in the admission rate occurred.

On two or three occasions this winter there have been spells of hot weather followed by blizzards, with a corresponding rise and fall in the admission rate for recurrent malarial fever.

With the increase of temperature in the summer months we find cases of malignant malaria occurring (which are rare in the winter), until towards the end of the malarial season this type is very frequent, the maximum intensity being reached towards the end, about October to November; from then onwards it gradually declines until from March to June such cases are seldom seen. Such was the experience in 1916, 1917 and 1918. The question has arisen whether the *A. superpictus* carries the subtertian parasite entirely or better than the *A. maculipennis*, as it is more prevalent during late August and September when subtertian malaria is most in evidence.

During this winter the corps sanitary section caught 62,000 hibernating anopheline mosquitoes, few males were found and these only at the beginning of the winter; mosquitoes examined were not found to carry the parasite.

(D) Conclusions.

As a result of this intensive course of quinine to nearly 39,000 men the opinion has been formed that complete sterilization of the blood cannot be obtained, that the drug is able to kill off young ring forms, but has no effect on gamete forms; that it has a powerful action by this method of administration of rapidly raising the hæmoglobin of the blood. It is also safe to administer such a course of quinine under ordinary conditions.

The chief measures therefore on which we must rely for the eradica-

tion of malaria are those directed to: (*a*) the primary destruction of the mosquito throughout all stages of its development, conducting a very vigorous warfare by means of drainage and canalization, oiling or cresolizing of pools, laying down traps and destruction of brushwood and undergrowth, which measures, to be thorough, should be maintained throughout the whole year in malarial countries; (*b*) the protection of man from the bites of mosquitoes by means of mosquito-proof buildings, nets, gloves, veils and the use of deterrent ointment; (*c*) destruction of hibernating mosquitoes; (*d*) the cure of the infected to be attempted in the winter months, or (*e*) their removal to cold climates where anopheline mosquitoes are non-existent; (*f*) the maintenance of a high standard of general sanitation.

Finally, *prophylactic* quinine is a waste of time and money, and a measure which, on account of its futility, is exceedingly unpopular with those who have to take it. *Curative* quinine is at present our most powerful drug, but is uncertain in its action and disappointing in its results, and we should search for some other remedy for the destruction of the malarial parasite and the cure of malarial fevers.

DYSENTERY—A CLINICAL STUDY.

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The character of the stools in dysentery varies in more or less regular fashion from day to day. In an acute case the stools are at first wholly composed of blood and mucus in varying proportion, the former being sometimes the chief element, sometimes merely a streak or two in a mass of glairy mucus. At first fresh and "bloody" in appearance, it soon changes its character, the red cells disintegrating and staining the mucus a rusty colour. Pus soon makes its appearance in varying amount, the blood disappears altogether, the mucus becomes opaque and more thick, and finally less and less in amount, until it finally disappears.

As soon as the bowel is emptied of its original fæcal contents the stools are wholly composed of catarrhal products. The first sign of improvement is the addition of fæcal matter, at first abnormal; perhaps offensive in odour, at any rate abnormal in colour, consistence, and composition, little specks or masses of blood, undigested food, exudate, and fæces being mingled together. In cases which are progressing satisfactorily the administration of bismuth causes blackening of the stool, but in cases which are not progressing satisfactorily no blackening ensues. The point is of value with regard both to prognosis and to treatment. As further progress ensues, the stools become homogeneous and more or less normal in colour and consistence, though they may be loose, semi-formed or formed; while the blood mucus and pus may still obtain, but are now discrete and apart from the fæcal material. In time they disappear.

We are accustomed to talk of (1) dysenteric stools (blood and mucus), (2) abnormal stools, and (3) normal stools.

Captain Mackie also recognizes three stages in the stools of acute dysentery from the bacteriological standpoint. In the first dysentery bacilli are present; in the second they have disappeared, but the flora is abnormal, *B. Morgan*, *B. fæcalis alkaligenes*, *B. C.L.A.* 1, *B. C.L.A.* 2, streptococci, etc., being present. In the third *B. coli* is predominant (Cf. protocols, p. 278.)

In many cases of clinical dysentery no dysentery bacilli are present, but the bacteria of Captain Mackie's second stage (concomitants) are

CASES OF DYSENTERY SHOWING THE NUMBER AND CHARACTER OF THE STOOLS FROM DAY TO DAY AND THE BACTERIOLOGICAL REPORT.

Serum 80 c.c.

Days of disease.	Number of stools per diem	Character of stools	Bacteriological report on stools
On admission			
5	Frequent	Bloody muco-pus	—
6	do.	—	*B. dysenteriæ* (mannite-fermenter atypical)
7	do.	Very bloody	—
8	do.	More fæcal, less bloody ..	*B. dysenteriæ* (Shiga)
9	do.	Bloody mucus	,, ,,
10	9	Pink muco-pus	—
11	10	Fæcal, bloody muco-pus ..	*B. dysenteriæ* (mannite-fermenter atypical)
12	10	Fæcal, bloody pus	—
13	5	Fæcal, some exudate	—
14	6	—	—
15	6	Semi-solid, some exudate ..	*B. dysenteriæ* (Shiga) *B. C.L.A.* 2
16	3	Semi-solid, slimy	*B. paracolon*
17	3	Formed	*B. C.L.A.* 2
18	2	Formed, some exudate ..	—
19	2	Fæcal	*B. C.L.A.* 2
20	2	Formed, a little exudate ..	*B. dysenteriæ* (mannite-fermenter atypical)
21	1	Fæcal, a little exudate ..	—
22	1	Normal	*B. paracolon*

No serum.

Days of disease.	Number of stools per diem	Character of stools	Bacteriological report on stools
On admission			
6	—	Bloody mucus	—
7	9	Very offensive, bloody mucus	*B. dysenteriæ* (mannite-fermenter)
8	8	—	—
9	6	—	—
10	4	Fæcal, slimy, some fresh blood	—
11	4	—	—
12	4	—	—
13	3	Fæcal, some pus	—
14	3	Fæcal, some mucus	—
15	4	—	—
16	4	Formed, some mucus.. ..	*B. dysenteriæ* Y, *B. fæcalis alkaligenes*
17	4	,, ,, ,, ...	*B. dysenteriæ* Y, *B. fæcalis alkaligenes*
18	5	,, ,, ,, ...	*B. dysenteriæ* Y, *B. fæcalis alkaligenes*
19	5	A very little mucus, normal..	*B. fæcalis alkaligenes*

No serum.

Days of disease.	Number of stools per diem	Character of stools	Bacteriological report on stools
On admission			
4	—	Bloody mucus	*B. Shiga, B. fluorescens*
5	Frequent	Very bloody mucus	,, ,,
6	5	Fæcal, bloody mucus	*B. fluorescens*
7	2	Fæcal, mucus	Cocci
8	5	—	*B. coli*
9	4	Fæcal, a little bloody mucus..	—
10	2	Normal	—

CASES OF DYSENTERY—*Continued.*

No serum.

Days of disease.	Number of stools per diem	Character of stools	Bacteriological report on stools
On admission			
4	—	Bloody mucus-pus	*B. dysenteriæ* (Shiga) and *B. dysenteriæ* (mannite fermenter atypical)
5	16	,, ,, ...	*B. dysenteriæ* (Shiga)
6	13	Fæcal, bloody mucus	*B. fæcalis alkaligenes*
7	16	More fæcal, muco-pus ..	—
8	10	Fæcal, more mucus	*B. Shiga*, *B. Morgan* 1
9	6	Mucus, pus	,, ,,
10	3	Fæcal, exudate and small sloughs	*B. Morgan* 1
11	5	Pus	,,
12	1	—	,, *B. fæcalis alkaligenes*
13	2	More fæcal, pus	*B. fæcalis alkaligenes*
14	2	—	*B. paracolon*
15	2	—	—
16	—	—	—
17	—	Normal	—

No serum.

Days of disease.	Number of stools per diem	Character of stools	Bacteriological report on stools
On admission			
8	8	Loose fæcal	*B. dysenteriæ* (mannite fermenter atypical)
9	6	Much blood, muco-pus ..	—
10	8	Very bloody	*B. dysenteriæ* (Shiga)
11	8	Very bloody, mucus	—
12	5	Bloody mucus	*B. dysenteriæ* (Shiga)
13	4	Bloody muco-pus	*B. paracolon*, type
14	3	Fæcal, mucus	—
15	3	—	—
16	3	Fæcal, some pus	*B. dysenteriæ* (mannite fermenter atypical)
17	2	Fæcal, some pus and blood ..	*B. C.L.A.* 2
18	2	Fæcal, a little mucus and blood	*B. dysenteriæ* (mannite fermenter atypical) *B. fæcalis alkaligenes*
19	Enema	Fæcal, a little mucus.. ..	*B. dysenteriæ* (mannite fermenter atypical)
20	—	,, ,, ,, ...	—
21	3	—	*B. dysenteriæ* (non-mannite fermenter atypical) *B. C.L.A.* 2
22	4	Fæcal	—
23	Enema	—	—
24	—	—	—
25	3	Normal	Cocci only

No serum.

Days of disease.	Number of stools per diem	Character of stools	Bacteriological report on stools
On admission			
2	7	Blood and mucus	*B. dysenteriæ* (Shiga)
3	18	Blood and mucus, fæces ..	,, ,,
4	13	—	,, ,,
5	Frequent	Blood and mucus	,, ,,
6	13	Fæcal, blood, muco-pus ..	,, ,,
7	10	Fæcal, less blood, exudate ..	*B. coli* type
8	6	Muco-pus, a little blood ..	*B. dysenteriæ* (Shiga) *B. fæcalis alkaligenes*
9	10	Bloody muco-pus	—
10	6	Fæcal, mucus, little blood ..	—
11	4	More fæcal	*B. fluorescens*

found, sometimes in enormous numbers;[1] and the question naturally arises as to whether these organisms can by themselves produce dysenteric symptoms.

A priori there is no reason to the contrary. A catarrh of the bronchi or of the bladder may be due to many organisms, though in each case, from reasons special to the viscus or to the common mode of infection, particular bacteria are most commonly found. It seems certain that these concomitant bacteria may be pathogenic in bowels already injured by a dysentery bacillus or *E. histolytica*, and not at all unlikely that they may produce the clinical symptoms of dysentery, i.e., colitis. The proportion of cases in which they are the sole infection is, in all probability, not large.

We have tried to elucidate the point by investigating the agglutinating action of the blood serum of fifty-three convalescent dysenteric patients. The results are indefinite and further examinations are required. Of ten cases where *B. dysenteriæ* Shiga was isolated from the stools during the acute stage, the serum of 5 agglutinated it in dilutions varying from 254 to 1,024; but in 5 only agglutinated up to 16, 16, 32, 32, 64. Of 8 *B. dysenteriæ* Flexner cases the agglutinative dilutions were 8, 8, 16, 128, 128, 160, 512, 1,024. So that agglutination reactions may be positive or negative in these forms of dysentery.

The reactions with the atypical bacilli are also indefinite. Of 7 cases, 6 agglutinated *B. Shiga* in dilutions of 16, 16, 32, 64, 320, 512; while *B. Flexner* was agglutinated in 4 cases with dilutions of 8, 16, 32, and 1,024. The particular organism isolated was agglutinated in 2 cases in dilutions of 128 and 1,024 and was not agglutinated in 3 cases.

Of 7 cases where *B. Morgan* 1 was alone isolated from the stools, 3 agglutinated *B. Shiga* in dilutions of 8, 16, 320; and 5 agglutinated *B. Flexner* in dilutions of 15, 40, 80, 256, 512. Of 7 cases where *B. fæcalis alkaligenes* was isolated from the stools, 2 agglutinated *B. Shiga* in dilutions of 256 and 512; and 2 agglutinated *B. Flexner* in dilutions of 32, 256. So that it seems certain that some of the cases in which the concomitant bacteria alone, or atypical bacilli, are isolated from the stools have been due primarily to infection by one of the classical dysentery bacilli. But as we have shown, classical dysentery bacilli are not invariably agglutinated by the serum of patients from whose stools they have been isolated, so that no conclusion can be reached.

While laboratory investigations are undoubtedly necessary to determine the type of dysentery prevailing in any particular locality, we must confess that the assistance which they can give to the physician in the treatment of an individual case is usually slight. As we have already indicated, no dysenteric bacilli were found in many of our most acute bacillary cases;

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[1] Two thousand eight hundred and forty-two cases examined. "Concomitant" bacteria in 554 cases in which *Entamœbæ*, *B. dysenteriæ*, and *B. dysenteriæ* atypical were absent.—Report of Medical Advisory Committee.

and in many chronic cases coming from Mesopotamia, almost certainly of amœbic origin, who derived much benefit from emetine treatment, no amœbæ were discovered.

In a few cases valuable aid is rendered, but in the great majority the clinician must act without reference to bacteriological and microscopic findings. We have already stated that we are somewhat sceptical of the existence of *pure* amœbic dysentery. We are becoming equally sceptical of the existence of pure *chronic* bacillary dysentery. Our custom now is to treat all chronic or relapsing cases as amœbic in origin, whether entamœbæ or bacilli are or are not discovered in the stools. For without some form of ipecacuanha treatment an amœbic infection of the bowel almost invariably progresses, slowly, but surely; and its administration in bacillary cases is at any rate harmless. The fatal cases recorded above are sufficient evidence of the accuracy of our conclusion.

The value of anti-dysenteric serum in the treatment of dysentery is still *sub judice*. The serum is obtained by immunizing horses with various strains of the "classical" dysentery bacilli, and seems to have proved of value in certain epidemics of which presumably the classical bacilli were the cause. But some forty per cent of our bacillary cases showed atypical organisms, which did not react with homologous sera, and the value of the specific remedy is in consequence in question. The horse serum, of course, may be of use but that is beside the point.

We have used serum fairly freely in cases where we had reason to believe that the cause was bacterial and in which toxic symptoms were prominent, giving 40, 60, or 80 cubic centimetres as a dose and repeating it as seemed indicated. Our maximum total dose was 140 cubic centimetres. We have observed good results to follow its administration, but we have also seen equally good results in cases where from some particular reason no serum was administered.

It seems probable that the value of serum is greatest in the first three or four days of the illness, at the time when the specific infection is at a maximum, and prior to the formation of gross lesions in the bowel; and that it is of less or little value in the second week of the disease after ulceration has occurred and a multiple bacterial infection has taken place, It is probably of greatest value in cases that are toxæmic, and the degree of fever, the pulse rate, and the general appearance of the patient should be specially noted. The character and number of the stools are less valuable as a guide. A dose of less than sixty cubic centimetres is probably insufficient, and a second injection may be made on the following day. The results of bacterial examination must not be awaited before the serum is administered, for as we have already mentioned its value is greatest in the early days of an attack, and it takes three or four days to complete the bacteriological examination of a stool.

We have been unable to form a definite opinion as to the value of serum in the treatment of bacillary dysentery, for the cases which we have

observed were too varied in character on their admission to our wards to be truly comparable. We have, however, felt that in severe cases the possible benefits of its administration should not be withheld, especially as we have so far failed to observe any injurious effects to follow its administration. But we are convinced that the *general treatment of the case is of much greater importance than the administration of serum*, which should be used only as an adjunct to and not as a substitute for the general treatment.

Arthritis (Cases of Serum Arthritis are not included).

Arthritis occurred in seven cases of this series. In one case it was mild, the patient complaining of pain in his knees and ankles for about a week which interfered with his sleep and was increased by movement. The joints were tender but were not swollen. There was no fever. Recovery was rapid and complete. He had previously suffered from rheumatic fever on two occasions and had had a subacute recurrence three months previously, which did not necessitate his entering hospital. An attack of dysentery of mild type ensued on September 26, and by October 10 the stools were normal. On October 19, however, his ankles became tender, swollen and painful, and this lasted for a week. There was no fever, and his recovery was rapid.

The other cases were more severe and in a general way presented the same features, the arthritis being a synovitis with practically no peri-articular swelling, and being accompanied by fever.

A yeoman, aged 21, was admitted to hospital on September 19 with dysentery of a week's duration. There was then no fever, but the abdomen was tender and the stools, composed of bloody mucus, numbered fifteen on the day of admission. Improvement was rapid, and the stools were normal after September 29. He now, however, began to complain of pains in his ankles, though these seemed normal save that they were tender. On October 3, however, the right knee-joint was found to be distended with fluid and next day the left knee was similarly affected. He slept badly at night on account of pain. On October 6 the knee seemed in much the same condition, but the left ankle was now involved. On October 7 the left ankle was more swollen, while the knees were less tense. On October 9 the arthritis was subsiding, and the ankle seemed normal on October 12, though the knees were still involved. On October 16 the ankle again became swollen for a day or two, but his subsequent progress was good, and the joints were normal on October 22.

The patient was evidently suffering from a bacillary dysentery, but no specific organisms were isolated from the stools which, however, contained *B. fæcalis alkaligenes* and streptococci previous to the onset of the arthritis. The stools seemed normal at this time, and remained normal subsequently. The left knee was punctured on October 6, but the fluid was sterile. It was opalescent in colour with a large cellular content which on differential count showed polymorphonuclear cells 72 per cent; large mononuclear

4 per cent; small mononuclear 22 per cent: and endothelial cells 2 per cent (Captain W. Campbell). We have only had cultures made in one other case where the left knee-joint alone was involved. In this case *B. coli communis* was isolated. We were inclined to regard this as due to some accidental contamination, but Phillips has recorded a similar case, which suggests a causal relationship.

Three other cases were of similar type. They were all apparently bacillary dysenteries, but cultures were only positive in one case where an atypical mannite non-fermenter bacillus was detected. Before this patient left hospital a mild recrudescence of dysenteric symptoms ensued, and the *E. histolytica* was discovered, so that the infection was probably mixed at the outset. In none of the other cases were entamœbæ found. The records in one case are unfortunately missing. This was the patient from whose knee-joint *B. coli* was isolated. He was inclined to athletic pursuits, and had had traumatic synovitis on two previous occasions. Another patient, whose arthritis developed on the eighteenth day of his dysentery at a time when the stools still contained some cellular exudate, had been laid up for a month with rheumatism in the knees eighteen months previously. The joints affected were the knees and the right metacarpo-carpal joints; the arthritis persisted for nearly six weeks, though the fever was slight (100° F.) and disappeared after three weeks. In the sixth case the arthritis ensued on the twenty-first day, the knees and the proximal joint of the right great toe being involved. The fever touched 101° F. and lasted for twelve days, while the arthritis lasted for seventeen days. The stools at the outset still contained some cellular exudate.

We have little doubt that the arthritis in these cases was the result of the gastro-intestinal disease and due to a bacterial infection of the joints. We have, unfortunately, little information with regard to the bacterial contents of the joints either in our own cases, or in the scanty literature on the subject. We have no evidence as to the presence of dysenteric organisms in the effusions which might qnite well be due to infection by the "concomitant" bacteria, or by *B. coli*. But we are convinced that these cases are not merely examples of acute rheumatic fever occurring in persons who happen to be at the time convalescing from dysentery. There is little or no peri-articular swelling, the pain is slight as contrasted with the signs of arthritis, profuse sweating does not occur, and the cardiac valves are not involved; while the arthritis does not react to salicylates in the rheumatic fashion, though this drug undoubtedly mitigates the discomforts. The comparison is rather with gonococcic arthritis, and in both cases recovery is incomplete until the primary source of the infection has been cured. None of these patients showed any signs of recent gonorrhœa, and in no case had serum been administered.

In another case the sequence was not quite so clear as the arthritis occurred in a patient who had been liable to "rheumatism in the joints"

for several years, and may thus have been a recrudescence of a pre-existing disease. He was a man aged 47. The diarrhœa ensued on October 4, 1916, and blood and mucus appeared in the stools on October 6, but disappeared after October 14. *B. C.L.A.* 2 alone was isolated from the stools. His tongue was slightly coated during his residence, but otherwise gastro-intestinal symptoms were in abeyance.

The arthritis commenced on October 14, when the knees and ankles became painful and tender. Two days later the right knee and ankle became swollen, a considerable effusion taking place into the knee-joint. These symptoms decreased after a couple of days, but did not disappear, and on October 22 the joints of the right foot, the metacarpo-phalangeal joints of the right hand and the right elbow became involved. On his dismissal to England on December 7, 1916, his symptoms were much abated, but there was still some fluid in the knee, and the ankle, elbow and hand were still swollen. He had slight fever on admission, which became intensified from October 15 to November 1, and persisted in slight degree until dismissal.

The history of the case and its subsequent course suggested an acute relapse of a chronic rheumatoid arthritis rather than an attack of "dysenteric" arthritis.

	Age	Previous history	Infection	Joints involved	Date of arthritis	Duration of arthritis	Fever	Duration of fever	Character of stools	Effusion	Serum
(1) W. ..	27	Rheumatism of knees 18/12 previously	*B. dys.* M. F. *Ent. hist.*	Knees, ankles, right metacarpo-carpal joints	Day 18th	Days 40	Yes	Days 17	Abnormal	?	—
(2) D. ..	31	—	—	Knees, ankles	21st	7	—	—	Normal	None	—
(3) D. ..	20	—	—	Knees, phalangeal joint of right great toe	21st	17	Yes	12	Abnormal	?	—
(4) L. ..	21	—	*B. fæcal. alklig.* Streptococci	Knees, ankles	19th	21	Yes	12	Normal	Sterile	—
(5) Y. ..	23	Several attacks of rheumatism	—	Ankles	23rd	6	—	—	Normal	?	—
(6) S. ..	?	Traumatic synovitis	—	Left knee	?	?	—	—	?	*B. coli*	—
(7) ..	47	Rheumatism for several years	*B.C.L.A.* 2	Right knee, ankle, foot, elbow and hand	10th	54	Yes	54	Normal	Yes	—

Cardiac Symptoms.

We have been unable to recognize any cardiac symptoms which are peculiar to dysentery, although cardiac symptoms are not infrequently prominent. In dysentery we are dealing with a disease in which toxic symptoms are not uncommon (bacillary dysentery), and in which in consequence the pathological lesions (granular and fatty changes) which obtain in all the affections are almost certain to occur. In dysentery the physical exhaustion entailed by the frequent call to stool, the abdominal pain, and the loss of sleep is very considerable; and the muscular weakness which is so well-marked in early convalescence in the muscles of the limbs, will naturally obtain also in the cardiac muscle, and will be intensified by exposure, hard physical exertion, etc., such as occurred on the Peninsula and in Mesopotamia. A long railway journey, a rough sea voyage, and even the carrying of a heavy kit at the railway station, have all in our experience produced serious cardiac symptoms of a temporary kind; while at the present time our armies contain many men of under average physique who have previously been engaged in sedentary occupations, as well as many where cardiac reserve has been previously weakened by antecedent disease of varying character, in whom the breaking strain is necessarily small. We have seen patients with œdema of the extremities, with dyspnœa or palpitation upon exertion, dizziness, faintness, and the like; we have observed dilatation of the heart, mitral reflux and extra-systoles on several occasions. But we have not met with any cardiac disability which we have not seen in pneumonia or in enteric fever; and the proportion of cases in which such symptoms have been present does not seem to us to be nearly so large as in the former disease. We have not seen any cases of heart-block, auricular fibrillation or auricular flutter, and we have not seen any cases of acute endocarditis.

In acute dysentery it is essential to prevent cardiac strain in every possible way. The bedpan must be substituted for the latrine, and in serious cases even the bedpan should be forbidden and the evacuations passed into pads. Careful nursing, too, is of the greatest value. When stimulants are required we have found alcohol, ammonia, and digitalis of value.

The Relations of Enterica and Dysentery.

There has been considerable discussion as to the relationship of dysenteric symptoms and enterica, as the former were not infrequently present in cases shown to be enterica by bacteriological methods. The question was brought to our notice by the following case:—

The patient, who had not previously been out of England, was attacked by dysenteric symptoms, accompanied by fever on June 9, 1916, and when admitted into hospital on June 13, 1916, was passing many stools which were wholly composed of rose-coloured mucus. This continued for four days, when the blood disappeared, the stools still containing muco-pus.

On June 24, 1916, the stools were normal and he seemed convalescent, the fever which was present on admission having gradually fallen and reached normal on June 21, 1916. The general symptoms, headache, prostration, etc., had also disappeared. On June 25, however, the fever recurred, accompanied by a measly rash and arthritic pains—a serum reaction which had followed the administration of eighty cubic centimetres of serum on admission. On June 28 the serum rash and arthritis had disappeared, but the fever persisted, the spleen was enlarged and some rose-coloured spots were present on the trunk. A blood culture gave a pure culture of *B. paratyphoid* A. The fever persisted until July 3, 1917. The patient made an uninterrupted recovery. No dysenteric symptoms were present during the second febrile attack.

We at first looked upon the case as one of bacillary dysentery, followed by enterica, the infections being simultaneous, while the attacks followed in sequence owing to the varying length of the incubation period in the two diseases. But dysenteric bacteria were not detected in the stools during the primary attack, and Colonel O'Sullivan suggested that the two illnesses might be due to the same infection, the first attack chiefly involving the lower bowel, while in the relapse the lower bowel escaped. Two similar cases shortly afterwards came under our notice.

A definite conclusion cannot be reached in this case as a blood culture was not taken during the initial attack. The blood when subsequently tested for agglutinative reactions to *B. dysenteriæ* Shiga, Flexner and Y failed to show any reaction. The dysentery may, of course, have been due to atypical organisms. We have shown, too, that positive agglutinative reactions are by no means constant in bacillary dysentery.

In enterica the large bowel is sometimes notably affected. We have seen well-marked ulceration of the colon, extending even as low as the descending colon, both at home and in South Africa, and another case has recently come to our notice. In this patient, who died from perforation and peritonitis, the usual ulcers were present in the small intestine; one ulcer about the size of a split pea was present in the cæcum; and several large ulcers were present about the splenic flexure and in the descending colon. The pelvic colon and rectum were not involved. Captain W. Campbell considered the whole condition to be enteric in origin. *B. typhosus* was isolated in culture from the blood during life. No dysenteric symptoms were present during his residence in hospital.

The literature which we have been able to consult shows that ulceration of the large bowel is not uncommon in paratyphoid infections. In Stolkind's series ten of one hundred cases showed lesions similar to those of dysentery. Job and Ballet record a case in which there was deep ulceration of the sigmoid flexure and rectum. In Dawson and Whittingham's cases nine out of seventeen showed some ulceration in the large bowel. Rathery also found ulceration of varying depth and size in the colon.

We have had considerable experience of enteric fever both at home and in South Africa, but we have not met with the combination of dysenteric symptoms and enterica until we encountered it in Alexandria.

During 1915 dysenteric symptoms were not uncommon in Alexandria among the enterica cases. In the majority, however, they were the result of a double infection with *E. histolytica* and *B. enterica*. Captain Ford has recorded thirty-four cases, and in thirty-two of these a definite amœbiasis was shown to be present on examination of the stools. Captain Dunne had a similar experience. We have already recorded a case in which the two infections co-existed.

The co-existence of bacillary dysentery and enterica has only been noted in a few cases. One occurred in Captain Dunne's wards, the two organisms being isolated at the same time from the blood and from the stools. But, as we have shown, the *B. dysenteriæ* is not detected in the stools in a majority of cases which are clinically bacillary dysentery; so that the failure to isolate *B. dysenteriæ* from the stools of cases of enterica in whom dysenteric symptoms are present can hardly be reckoned to exclude their presence.

We have habitually taken blood cultures in our febrile cases of bacillary dysentery, but the results have been consistently negative.

We have been unable to find much information upon the point in such literature as we have been able to consult. Carles, however, has recorded a case in which he recovered *B. paratyphoid* A from the blood of a fevered patient who was on admission passing many stools composed of bloody mucus. No dysenteric organisms were found in the stools.

Captain Hirst informs us that an epidemic of dysentery which occurred at Wrexham about 1911 was due to a paratyphoid infection. We have been unable to consult the reference.

On the available data we are inclined to look upon the occurrence of dysenteric symptoms in cases of enterica as due to a coincident infection with *E. histolytica* or *B. dysenteriæ*.

Lamblia Intestinalis.

The influence of *Lamblia intestinalis* upon the gastro-intestinal functions is still undetermined. It is frequently present in the stools of patients suffering from diarrhœa, dysentery, etc., and was peculiarly prevalent among the troops evacuated from the Peninsula on account of these diseases. But it is often found in the stools of patients who have not at the time any intestinal symptoms or in whom, though symptoms are present, other possible causes for their existence are at the time active, or have been active in the immediate past.

The confusion which arose as to the nature of the dysenteries prevalent in 1915-1916 in the Eastern Mediterranean was due to a simple cause, namely, the incomplete examination of the stools. In many cases the

examination was purely microscopic, in others purely bacterial, and opinions were formed on an imperfect knowledge of the facts. In some cases the gastro-intestinal tract is heavily infected (in one of our patients *E. histolytica*, *Lamblia*, *B. dysenteriæ* Shiga, *B. fæcalis alkaligenes*, *B. paracolon* 2, *B. C. L. A.*, and streptococci were isolated within a few days from the stools), and the influence of any particular parasite in the production of the symptoms which are present can hardly be estimated. But the opinion is gradually forming that in some cases Lamblia may be the cause of chronic diarrhœa, and in a few patients may produce symptoms closely simulating dysentery. Lieutenant-Colonel Wenyon "suspects that sometimes at any rate it may produce sufficient irritation of the small intestine to justify us in regarding it as pathogenic." Dr. Fantham and Miss Porter consider that "it is pathogenic to man and is capable of producing diarrhœa." They have shown too that it is pathogenic to kittens and to mice. Major Hurst thinks that in some cases Lamblia is probably the cause of gastro-intestinal symptoms.

We have examined our own records from this point of view but are unable to arrive at a definite conclusion. In dysentery, Lamblia is not infrequently present in the stools, and in our series was detected in more than fifty cases, either in the free state or encysted. In the large majority, however, their presence was intermittent, and intestinal symptoms were at the time either slight, or in abeyance.

In eleven cases, however, intestinal symptoms were present and a causal relationship was possible. Analysis of these cases unfortunately fails to give any decided answer to the question, for in eight cases other infections were either simultaneously active, or had been active immediately before. In three cases an amœbic infection was noted. In two a bacillary infection, and in three tetramitus.

In three cases alone was the infection pure. One of these patients had been ill, off and on, for many months and had almost certainly suffered from amœbic dysentery at the outset, though entamœbæ were no longer present in the stools. The second patient was admitted acutely ill with dysentery probably of bacillary origin, though no bacilli were isolated from the stools, and subsequently showed a Lamblia infection associated with diarrhœa. In the third, the symptoms seemed probably to be due to Lamblia.

In five cases an association between the Lamblia infection and the symptoms seemed extremely probable, though other infections co-existed. The most striking example was that of a patient who had suffered from dysentery in May, June and July. After his admission to hospital, *B. dysenteriæ* Shiga was found in the stools on July 10, and on August 3, 1916. Entamœbæ was detected for the first time on August 19, and a course of emetine hypodermically and ipecacuanha by the mouth was immediately instituted. This ended on August 31. Considerable improvement had ensued during the course, but on August 30 he passed three stools which

contained mucus in very large amount. Many Lamblia, both free and encysted, were present, but no other protozoa or bacteria, though the stools were examined on August 30, 31, and September 1, 3, 5, 6, 7, 8, 9, 11, 13. The Lamblia infection was last detected on September 3, and the symptoms rapidly disappeared.

In the other cases the stools were of different type. Some mucus was generally present, but never in large amount. The stools were numerous, very bulky and much larger than one would have anticipated considering their number. They were of varying colour, ochre, brown, or grey, and very often showed evidences of fermentation in the shape of bubbles of gas scattered here and there throughout them. Sometimes they were orange coloured, but this is not pathognomonic for we have seen such stools in cases where Lamblia was never present.

In the second case a mannite-fermenting bacillus had been isolated a short time previously. In the third *B. fæcalis alkaligenes*, in the fourth *B. paracolon*, in the fifth tetramitus, co-existed. But in all these cases disappearance of the Lamblia coincided with remission of the symptoms.

The presence of Lamblia in the stools is peculiarly intermittent and they appear and disappear even from day to day, so that their causal relationship to any symptoms that may be present is still further confused.

We are inclined to believe that, although in the majority of cases Lamblia is innocuous, in a minority they can produce symptoms which somewhat closely simulate dysentery, a result which is more likely to obtain if other pathogenic organisms co-exist, or have recently been active.

The treatment of Lamblia infections requires further investigation. It is comparatively easy to remove them temporarily by the administration of bismuth salicylate in sixty-grain doses three to six times a day. Any coincident diarrhœa generally ceases rapidly. But the Lamblia as a rule reappear when the salicylate is stopped, sometimes within three or four days, though now frequently without any objective symptoms.

In three of our cases, however, the infection seemed to be completely removed. One of our patients received forty-five grains of sodium salicylate for twelve days, followed by 180 grains of bismuth salicylate for thirteen days. The second received forty-five grains of the sodium salt for twelve days and after an interval of eight days 180 grains of the bismuth salt for twenty-nine days. The third patient received 180 grains of the bismuth salt for fourteen days.

We know, however, that the infection may not be eradicated by 180 grains given for seventeen days, and we would suggest that a three weeks' course be investigated.

With such large doses of salicylate we thought it advisable to confine the patients to bed. We have seen no ill effects in any of our patients.

Treatment.—One is apt to forget—in the treatment of dysentery—that we are confronted with *two* problems, (1) the local condition, and (2) the general health of the patient, factors which of course act and react upon

each other, but which demand in some respects separate consideration, and a separate line of treatment. In some instances one factor is predominant. In the early stages, for example, the local condition demands a starvation dietary. But in a later period of the disease the general health may be the chief consideration and a dietary which is not conducive to minimal irritation of the bowel may be forced upon one by the failure in nutrition as a whole. In every case and at every period of the disease due attention must be paid to this point.

The general health is investigated in the usual ways. The local condition can only be watched by similar methods and the tongue must be clean, the abdomen flat, painless and no longer tender, and the stools normal before the attack can be considered as ended. Too much attention cannot be paid to the investigation of the stools and the treatment must be largely directed by daily observation of them. And even on the same day the character of the stools may be varied and erroneous deductions may be drawn if an isolated sample is alone examined.

The first indication in treatment is rest. This can of course be only relative but the good effects of confinement to bed and the use of the bed-pan are at once manifest. In serious cases even the bedpan should be avoided and the stools should be passed into pads of tow or cotton wool. In dysentery the nights are disturbed by pain, tenesmus and calls to stool, and opium in some form (morphia, laudanum, chlorodyne) is of great value, not of course with a view to checking diarrhœa, a process which invariably produces an exacerbation of the symptoms after a temporary improvement, but to ensure some sleep and at the best a "short night" instead of a "long one." We prefer a hypodermic injection when the pain is severe, and an oral one if diarrhœa is profuse. Abdominal applications, a hot water bottle, hot compresses sprinkled with laudanum, anti-phlogistine, etc., are also comforting and of undoubted value.

The diet in dysentery is of great importance. The general indications are definite. It should be unirritating, and well digested; should afford a small and bland food residue and be as valuable as possible from the nutritional point of view. It has been said that the character of the food-stuffs matters little as they have reached a similar consistency whatever their original nature by the time that they have reached the ileo-cæcal valve, but repeated observations have convinced us of the fallacy of this statement. Regular inspections of the stools reveals in many cases extra-ordinary evidences of the inefficacy of oral and gastric digestion even in cases where no obvious oral or gastric disturbances are apparent. Ration bread, for instance, and potatoes are often easily recognizable in the stools, sometimes in considerable masses; as well as such things as raisins and the seeds of fruit. We have found it advantageous to eliminate cellulose from the diet until improvement is distinct. The foodstuffs must be such as are well digested, for the presence of undigested food in a heavily infected bowel leads to the formation of products which from their chemical

character are definitely irritating to the bowel; and their nutritional value should be fully considered, as malnutrition is an early and marked feature in every case of dysentery.

The accompanying dietaries show in detail the lines that we have adopted, and may be taken as examples of the general principles. The early dietaries are of course a starvation regime, but this has been adopted by us not from *a priori* theories but from practical experience in the wards; the later dietaries are excessive. These too have been adopted as the result of observation for we have often seen a loss in weight of over a stone after a comparatively short but sharp attack.

DIETS IN DYSENTERY.

Diets No. 1 and No. 2 in detail.

No. 1.		Ounces	No. 2.
6 a.m.	Tea	10	Tea.
7.30 ,,	Albumen water ..	6	Two beaten-up eggs with tea and rusks.
9 ,,	Brand's Essence ..	6	Barley water.
10.30 ,,	Barley water	10	Benger's.
12 noon	Beef tea	10	Beef tea. Custard or rice cooked in water.
1.30 p.m.	Albumen water.. ..	6	2 p.m. Jelly.
3 ,,	Jelly.		
4.30 ,,	Tea	10	Tea with rusks and biscuits.
6 ,,	Chicken tea	10	Chicken tea or bovril.
8 ,,	Albumen water.. ..	10	Benger's or arrowroot.
10 ,,	Bovril	10	Brand's essence.
12 midnight	Brand's Essence ..	6	Albumen water.
2 a.m.	Barley water	10	Bovril.
4 ,,	Albumen water.. ..	10	Benger's.

No. 3. Add. Eggs boiled or poached and junket or milk foods (Horlick's, Allenburys', etc.).
No. 4. Add. Fish cream, rice milk, puddings and toast.
No. 5. Add. Fish and bread.
No. 6. Chicken diet at first without potatoes, vegetables or porridge.
No. 7. Ordinary diet.

Note.—Articles mentioned in later diets gradually displace those in earlier diets.
Milk—citrated or peptonized—and chocolate were at times given with No. 2.

The chief indications in the selection of the sequence are the state of the tongue and the character of the stools. Even milk is badly borne if the tongue is coated, and an ample dietary can rarely be tolerated until the third type of stool is being passed.

The dietaries are of course but types. They were drawn up according to the possibilities of the situation and are capable of considerable improvement both in variety and in quality, in times of peace.

Fluid should always be given in ample quantity in particular during the stages of severe diarrhœa so as to compensate the loss of water. But quite apart from this, fluid in amount is desirable in order to dilute the poisons circulating in the blood and to aid in their elimination through the kidneys.

One exception may be noticed. During convalescence in a few cases diarrhœa of a watery type may persist indefinitely though the other symptoms have abated. We have seen considerable improvement follow the institution of a relatively dry dietary with a reduction of the fluid intake.

The Use of Drugs in Dysentery requires some Detailed Attention.

Diarrhœa.—One is always tempted to try and check diarrhœa in cases of dysentery, for the symptom is extremely distressing to the patient and by its continuance severely affects his nutrition and increases his exhaustion. But the current opinion, founded not on theory but on practical experience, holds strongly that any attempt in this direction is in the long run not only injudicious but is actively harmful. Patients who are being transferred from one unit to another are generally given a comparatively large dose of opium to ensure the minimum distress during the journey; but those who have witnessed the subsequent course of the disease in these patients are convinced that the temporary amelioration is dearly bought and is usually followed by a recrudescence or an exacerbation of the symptoms.

This applies not only to the cases in which the stools contain blood and mucus, but also to those in which "running diarrhœa" succeeds. For these cases of diarrhœa are truly, as has been well said, merely uncured dysentery, and require treatment of a type similar to that of the acute stage. The theory follows the fact. No one nowadays attempts to check the discharge of a septic wound by means of a gauze plug; on the contrary free drainage and irrigation are ensured, and in dysentery the same indications obtain. The bowel should be freely washed out and the bacteria and their products removed as thoroughly and as rapidly as is possible. One must remember that the former are largely situated *in* the wall of the bowel and the profuse secretion secured by the sulphates probably helps their evacuation from this site as well as removing the secretions in the lumen of the bowel. Free evacuation is desirable until some fæcal material appears in the stools; and subsequently a daily wash out is advisable. We usually give drachm doses of the sulphates every four hours in the early stages and subsequently an efficient dose each morning.

Regular inspection of the stools affords the desired information with regard to this point. If in doubt a "washed" stool may make the matter more clear.

The rule has of course an exception. In some cases where the stools indicate a minimal catarrh though the diarrhœa continues, small doses of opium are of undoubted value. But these cases are relatively uncommon.

The value of opium in the treatment of dysentery is, however, un-

doubted. But it is as a sedative—given at night—to ensure some rest and sleep that its beneficial action is most apparent.

We have used many of the astringent drugs in these cases and we have found that their value lies in conditions similar to those which we have just considered. It must always be borne in mind that these drugs tend to irritate the gastric mucous membrane and can rarely be continued with benefit for more than a few days.

Bismuth.—We agree with most writers as to the value of this drug. We give it regularly in large (ʒi) doses every two, three or four hours during the acute stages of the illness and subsequently in lessening amount. The carbonate of bismuth must be given; the subnitrate is of course poisonous in such doses.

Tragacanth mixtures are unsatisfactory. A watery mixture or a suspension in thin arrowroot are the best means of ensuring equality of dose.

A curious fact may be noticed here. In cases which are improving the administration of bismuth leads rapidly to blackening of the stools. In the acute stages, however, while blood and mucus constitute the motion no blackening obtains. This is probably due to the cessation of the peristaltic movements of the small intestine, as a similar result has been noticed by one of us after the administration of powdered charcoal. As improvement ensues, the stools become black and the discoloration may be taken as an index of the satisfactory progress of the case. The absence of discoloration on the other hand indicates incomplete evacuation of the bowel and demands treatment. Castor oil is generally efficacious if increased doses of the sulphates fail and we have often seen extraordinary improvement follow its use.

It has been suggested that this phenomenon is an indication that the lower bowel requires rest—rest which is spontaneously effected by cessation of peristalsis higher up; and that the saline treatment must therefore be harmful. Our own experience, however, as well as that of most writers on the subject, flatly contradicts this theory and we are convinced that the absence of blackening of the stools on this administration of bismuth is merely an extra indication for the continued use of the aperient sulphates.

These drugs, however, can easily be given in too large doses; what is indicated is evacuation of the unutilized contents of the bowel, and if diarrhœa succeeds the acute phase a dose every second or third day may be efficient for this purpose.

Enemata are often of value. During the acute stages they are as a rule contra-indicated. In certain cases, however, when tenesmus is extreme, a wash out with warm normal saline solution is sometimes soothing. The douche must be given very slowly at blood heat, and more than a pint or a pint and a half is rarely tolerated.

In the later stages, when the catarrh is subsiding, douches are often valuable. They are of especial value when the presence of unaltered

mucus, blood or pus around normal fæces indicate that the inflammatory process is situated low down. Two or three pints may be given in these cases, but the flow should be checked if any discomfort or pain is caused. The long tube is probably not required if the flow is slow and the pressure slight, and we generally use the nozzle of an ordinary Higginson's syringe attached to the end of the douche tube.

We have used most of the solutions that are usually recommended for this purpose, and we have found little difference in the results that we have obtained. It seems probable that the mechanical part of the process is the most valuable and that the sterile saline solution serves the purpose as well as anything else. The addition of a drachm of sodii bicarb. to the pint may facilitate the removal of mucus from the wall of the bowel. Eusol and saline in equal parts is another bland and efficient douche.

In protracted cases silver nitrate seems sometimes of value. Protargol (five per cent) is perhaps equally efficacious and is less painful. The bowel must of course be washed out previously with saline solution to remove mucus, etc., and permit of the silver salt gaining access to the tissues.

The sedative applications such as starch and opium enemata, morphia suppositories, etc., are sometimes useful if tenesmus is marked, but we prefer the hypodermic injection of morphia and atropine in efficient doses.

In protracted cases the lower bowel should be examined with the fingers and the proctoscope to ensure local treatment of local lesions near the anus. We have found on two occasions constrictions in these cases. In one of these the stricture disappeared after dilatation and a course of emetine. Entamœbæ were not recognized in the stools and the emetine was administered on general grounds. In the second case the stricture was thin and diaphragmatic and did not recur after dilatation. The ultimate progress was good.

In a small number of cases of acute dysentery the symptoms are choleraic in type, vomiting and diarrhœa being continuous and severe. The patient rapidly becomes collapsed with small thready pulse, cold extremities, cyanosis and subnormal temperature. The indications in such cases are of course obvious and the most important is the supply of saline solution by intravenous injection as in cases of true cholera.

In a certain number of cases of acute dysentery similar symptoms obtain though vomiting may be absent or minimal in degree. The good results which we have observed in cases of the choleraic type have led us to use intravenous injections when the indications were similar, though the degree of the disturbance was less severe, and the good results which we have observed have encouraged us to adopt the treatment more and more frequently. We have throughout used the hypertonic saline solution recommended by Rogers and supplied to the Service in the cholera outfit. Three or four pints has been our usual dose. In some cases we have added antidysenteric serum to the saline solution.

One further point requires to be mentioned. The more that we see of dysentery the more firmly are we convinced that the successful treatment of dysentery depends upon the treatment during the first few days of the disease. And if efficient treatment can be attained in the first forty-eight hours not only will the mortality be lessened, but the duration of the illness will be notably shortened and the efficiency of the fighting forces will be appreciably increased. No case of dysentery however slight at the outset should be treated lightly. If this rule is neglected serious symptoms will subsequently ensue in a considerable number of cases.

In conclusion, we desire to express our indebtedness to Colonel O'Sullivan, A.M.S., who from his ripe experience has given us much advice and assistance in dealing with the problems of dysentery, and to Captain R. H. Strong, who as head of the medical division of this hospital, has given us every facility for carrying on our work and has helped us in every way, and also to Captain Mackie and his colleagues at the Military Bacteriological Laboratory, Alexandria, for the bacteriological work they have kindly undertaken for us in connexion with this paper.

CASTELLANI'S ABSORPTION TEST.

By Captain W. BROUGHTON ALCOCK.
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The difficulties which have appeared when carrying out this highly specific and valuable test on human sera during and after infection or mixed inoculations have been great. Various and instructive researches have since Castellani's original work been carried out in England, especially by Boycott, Bainbridge and O'Brien, Cummins and Cumming. Because of its utility and aid, not only in the classification of agglutinins, but in the determination of particular strains of a group, an attempt has been made to devise a simple, practical, and reliable method of carrying it out as part of the routine work of the clinical laboratory. The method to be described has been developed from tests made during eighteen months on the blood sera of some 300 bacteriologically diagnosed and on other cases of single or multiple infections, and on inoculated subjects. Comparative agglutination examinations were made on the slide by the method described in a previous paper (see Journal of the Royal Army Medical Corps, April, 1918) before and after the absorption test, to distinguish the action of one or more specific agglutinins from that of co- or hetero-agglutinins.

Harvey and Wood (Journal of the Royal Army Medical Corps, 1910) showed that an excess of micro-organisms other than *Bacillus paratyphosus* A removed or reduced the amount of detectable specific agglutinin for *B. paratyphosus* A present in the serum. I have confirmed and extended this observation by proving that in a similar manner supersaturation of a serum with other than the corresponding emulsions removes or reduces the detectable specific agglutinins for *B. dysenteriæ* Shiga, Flexner-Hiss, and *Micrococcus melitensis*. I was therefore led to experiment with previously determined quantities of the factors employed in the test, and have endeavoured to evolve a method which would include in its technique the utilization of a *practically defined amount of micro-organisms and a practically defined agglutinin content of a serum*, and find that the following technique gives constant and reliable results.

Technique.—The *quantity of micro-organisms* employed is one drop ($\frac{1}{2}$ minim or $\frac{1}{36}$ of a cubic centimetre) of an emulsion standardized as described in the paper on agglutination.

The *dilution of serum* employed is that which shows on the slide the onset of agglutination of an emulsion of micro-organisms at approximately one minute of time. [On the same principle a defined quantity of agglutinin in human serum for each emulsion could be tried by the selection of a particular dilution of serum from amongst those showing a positive finding in the agglutination test done by the examination of a series of

increasing dilutions for each emulsion by my three full minutes' test on the slide or the old-established high-titre method.]

From three drops of this dilution one drop of the stock emulsion corresponding to the micro-organism of infection (and which has caused the development of the specific and any co- or hetero-agglutinins), removes or sufficiently reduces all these agglutinins; while one drop of any other emulsion that was agglutinated by reason of the presence of co- or hetero-agglutinins developed during the infection, removes only the respective co- or hetero-agglutinin. After absorption by an emulsion, the serum dilution is re-examined for agglutination on the slide with the fixed time limit of three full minutes.

Very rarely a particular dilution of serum from a case shows the onset of agglutination of two or three different bacterial emulsions at approximately one minute. It is, therefore, practically always necessary to put up two or three series of sedimentation tubes, each series containing the desired dilution of serum for one of the emulsions that is to be tested: and at the same time each of the other agglutinated emulsions is tested in that dilution.

An example will make clear the technique and the principles of the method. In the initial time-governed agglutination test on the slide, the serum of a patient is found to agglutinate three emulsions—*B. dysenteriæ* Shiga, *B. paratyphosus* A, and *M. melitensis*. To carry out the absorption test on the lines described it is found that respective dilutions of the serum are to be prepared and that *B. dysenteriæ* Shiga begins agglutinating at approximately one minute in a 1 in 6; *B. paratyphosus* A in a 1 in 160; and *M. melitensis* in a 1 in 10 dilution of the serum, then three series of the sedimentation tubes must be put up. In each tube of the first series three drops of the serum dilution 1 in 3 is placed; into each of the second series three drops of the serum dilution 1 in 80; into each of the third series, three drops of the serum dilution 1 in 5; into one of the tubes of each series is placed respectively one drop of emulsion of *B. dysenteriæ* Shiga, *B. paratyphosus* A, and *M. melitensis*. To each tube is then added two drops of sterile formalized saline. That the drop containing the emulsion may contain as nearly as may be practicable the quantity of saline necessary to make the dilution in the absorption tube equal to that in the control tube, the pipette, during the dropping of the emulsion is held at an angle of approximately 67½°.

A few drops of each serum dilution corresponding to that in each series are prepared in three other tubes, and kept each alongside the absorption test tubes of the series, so that each dilution can be later tested to control and compare its agglutinability with that of the absorbed serum dilutions in the other tubes of the same series.

The tubes when ready are gently shaken and capped with plasticine to prevent evaporation. They are left for twenty to twenty-four hours at laboratory temperature, or seven to eight hours at 37° C., or for two hours

at 55° C. The tubes containing emulsion were gently shaken once during these intervals, when left at laboratory or 37° C. temperature.

The tubes are then centrifuged, and a drop of the clear supernatant fluid of each tube of the first series is tested on the slide with a loopful of emulsion of *B. dysenteriæ* Shiga, a drop from each tube of the second series with a loopful of *B. paratyphosus* A and a drop from each tube of the third series with a loopful of *M. melitensis*.

Taking the first series, if there is specific agglutinin present in the serum for *B. dysenteriæ* Shiga the emulsion of *B. dysenteriæ* Shiga will be agglutinated at approximately one minute in the fluid from the tube containing *B. paratyphosus* A, and from the tube containing *M. melitensis*. If, however, the agglutination of *B. dysenteriæ* Shiga is due to a hetero-agglutinin action developed in a *M. melitensis* infection, the *B. dysenteriæ* Shiga will be agglutinated only in the fluid from *B. paratyphosus* A as the emulsion of *M. melitensis* will remove the hetero-agglutinin for *B. dysenteriæ* Shiga, and that of *B. dysenteriæ* Shiga will remove the agglutinin for itself.

Observations are then made on the second series of tubes to determine the specificity or otherwise of the agglutinin present in the serum for *B. paratyphosus* A, and on the third series to determine that for *M. melitensis*.

Simpler tests are more often called for, and the technique modified accordingly.

There is the possibility of pathogenic micro-organisms other than those of the seven groups represented and employed in the initial agglutination tests giving rise to a co- or hetero-agglutinin which might cause agglutination of one of the emulsions employed, but up to the present this has not occurred.

In rare dysentery cases strains approximating in biological characters to typical strains of the *B. dysenteriæ* Flexner-Hiss group have been isolated and found to be agglutinated by the patient's serum and not by specific Flexner-Hiss animal anti-serum. Of these particular strains each absorbed the agglutinin from the patient's serum but did not absorb the agglutinin from the Flexner-Hiss specific animal anti-serum, and the converse held when employing a typical agglutinating strain of *B. Flexner-Hiss*. This result appears of value in view of the work upon similar strains of *B. dysenteriæ* obtained both in France and in the Mediterranean.

A specific agglutinin may be distinguished from a co-agglutinin in infections with one of the enterica groups; and the presence of specific agglutinins to more than one group may be detected. Again, I was able by this test to distinguish the specific agglutinin for *B. aertrycke*, developed in nine bacteriologically proven cases, from the agglutinin for a *B. paratyphosus* B strain due to previous T.A.B. inoculations. An emulsion of *B. Gaertner* did not remove either agglutinin.

This method also showed that the specific agglutinin for *B. typhosus*

developed in serum in response to anti-typhoid vaccine inoculation might be temporarily increased by inoculation with anti-paratyphoid vaccine.

In the experiments carried out in developing this method it was found that specific agglutinins for *B. typhosus* or *B. paratyphosus* B were not reduced by supersaturation with any other emulsion tested than their respective emulsion. This fact permits the use of the supersaturation absorption test to determine if specific agglutinin for *B. typhosus* or *B. paratyphosus* B is present in a given serum.[1]

Immediate Absorption Test.—Occasionally but rarely it is noted in carrying out the initial slide agglutination test that two or three emulsions are agglutinated in such a manner as to indicate that an absorption test may be *tentatively* carried out on the slide. Useful information may be gained where serological tests are urgently called for.

From my limited experience of this immediate test and from the tentative work, it appears that one should use a dilution of serum that shows the onset of the *complete* agglutination of the emulsion to be tested at any time within the range of thirty to ninety seconds. The agglutinin content of the serum is not then too high for its necessarily sufficient absorption.

To give an example. In a *M. melitensis* infection it was found by the initial slide agglutination test on the serum that *V. choleræ* and *M. melitensis* emulsions were agglutinated immediately into rather marked flocculi, leaving the serum dilution clear. The highest dilution producing such complete agglutination within thirty to ninety seconds of both emulsions was determined, and in the drops thereof, each containing the agglutinated emulsion, the platinum loopful (two millimetres in diameter) of distilled water, to compensate for evaporation, was added. A similar loopful of the *M. melitensis* emulsion was placed in the agglutinated *V. choleræ* containing drop, and vice versa. On the re-examination made with the three full minutes time limit the *M. melitensis* was agglutinated and the *V. choleræ* not agglutinated; that is to say, *V. choleræ* was incapable of taking out the specific agglutinin for *M. melitensis*, while the *M. melitensis* removed the hetero-agglutinin for *V. choleræ*.

By a similar procedure co-agglutinins formed for *B. dysenteriæ* Flexner-Hiss in *B. dysenteriæ* Shiga infections, or co-agglutinin formed in *B. typhosus* infection (in non-paratyphoid inoculated patients) may be distinguished from specific agglutinins, etc.

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[1] Since writing the above I have employed this test during an outbreak of plague with most satisfactory results.

Clinical and other Notes.

LOBAR PNEUMONIA IN A BASE HOSPITAL IN FRANCE.

A Clinical and Pathological Study, with Special Reference to the Fatal Cases.

By Captain ARCHIBALD MALLOCH, C.A.M.C.
and
Major LAWRENCE J. RHEA, C.A.M.C.

Pneumonia is ever old and ever new, and, as it is such a serious disease, it is always worthy of study. We feel that this brief account of seventeen fatal cases out of a total of sixty-five of lobar pneumonia may be of interest, because the type of patient, the conditions under which they were living and working and under which they were treated, were all so different from those met with in ordinary private and hospital practice. We also hope that others may report similar series of cases from war hospitals so that the various aspects of the disease, seen under war conditions, may be fully displayed. All the cases with which we shall deal were of primary disease of the respiratory tract, and were in the hospital between January 1 and the middle of July, 1917. Statistics are always brittle things to handle, and in our small series of cases we do not wish to lay too great stress upon this side of the question. Whilst we have to do primarily with the fatal cases, reference will be made from time to time to those which recovered.

In the matter of treatment of the patients in a base hospital, we are of the opinion that owing to the excellent arrangements as regards food for the Army, to the unlimited supply of blankets, pillows, back-rests, etc., from the Ordnance Department, to the variety of drugs obtainable from the Army Base Medical Stores, and to the extra comforts supplied by the Red Cross, the sick have been at little disadvantage. An abundant supply of fresh eggs and milk has always been to hand.

The patients were concentrated in one hut which forms a part of the "line" under the charge of one of us. Cases of pneumonia, lobar or bronchial, occurring in connexion with wounds of the thorax or other parts of the body, were kept in the surgical wards, and these fall outside the limit of this study. It was deemed advisable to have the cases of pneumonia together in one hut, for several reasons which we shall point out below. Most of the cases diagnosed "pneumonia" and admitted from convoys, had already reached the convalescent stage before being moved down from the Front, and were retained in the medical ward which was receiving for that particular day. But if the patients received from local units or from convoys were in the early or critical stages of the disease, they were seen by Lieut.-Col. John McCrae, officer in charge of Medical Division, and were immediately transferred to the "pneumonia hut." By this arrangement, apart from the economy and division of labour, we have thought that the best interests of the sick have been served. They were thus put into a quiet and restful place, a consideration of the greatest import in the treatment of pneumonia. The

patients were not disturbed during any admissions of convoys, or during evacuations, as would have been the case in a large ward where there is so much coming and going. Nor were they upset by the necessary noise and bustle of an ordinary ward at mealtime, and by the inevitable gramophone. Many of the patients, too, have experienced relief in breathing on being transferred to the hut and on leaving the "Woodbine" atmosphere of a general ward. We have as far as possible in all weathers kept windows and doors open wide, and this would have been impossible in the presence of "up" patients. Indeed, so far have we considered fresh air of importance, that often the patients' beds were moved outside upon the grass beside the hut. In the "pneumonia hut" are about a dozen beds, and we have been allowed more nurses in proportion to the number of patients than is the case in the rest of the hospital, except perhaps in the hut reserved for wounds of the chest. Skilled nurses have thus been enabled to devote their whole time to the small number of patients. We have also been well supplied with orderlies. In the small kitchen under the same roof it has been possible to prepare special diets for the very sick. Although lobar pneumonia is classed in the Army as an infectious disease and broncho-pneumonia is not, we have made it a point of segregating both varieties of cases. The "pneumonia hut" has been under the care of one medical officer, who has had fewer patients to look after in his "line" than those in charge of other wards, and has thus been able to spend more time on those suffering from this disease. One of us (A. M.) who has looked after these patients in the ward has also been present and taken part in the autopsies which were performed by the other (L. J. R.). This we have felt to be a rare opportunity of correlating the symptoms and signs in the course of the disease with the findings at autopsy, of seeing one's mistakes, and of learning the limitations in attempting a diagnosis of certain of the complications.

All the patients admitted to the hospital were soldiers, with one exception, and he was a member of a civilian railway troop. The men had all been passed for active service, and except for a few in certain labour companies, were of remarkably good physique. The majority were between 20 and 40 years of age. Of the seven fatal cases in men of 40 or over, five came from "local" units, and were on active service at the base or on the lines of communication. We found that some of these men in their patriotism and desire to "do their bit," underestimated their age, and thus were taken on for foreign service. What a contrast with ordinary hospital work in a large city! Here on active service we have chosen for us, so to speak, what we should expect to be the most favourable class of patient, both as regards state of health and quality of physique. How many of the cases of pneumonia at home occur in poorly nourished men from the slums, in men who are habitual alcoholics, and in those who are already handicapped at the onset of the illness by some chronic cardio-renal, arterial, or respiratory disease. It is of some interest to note that many peoples from many climes within the British Empire were represented, and in the ward men from the British Isles lay side by side with Australians, New Zealanders, Canadians, and British West Indians. There were 47 British cases admitted and 16 died; 7 Australian or New Zealanders, and none of these died; 5 Canadians, and of these 1 died. We had only five negroes in this series and none of these died, although pneumonia in them seemed to take on a new aspect, characterized by long duration. Other hospitals have had more British West Indians and we

cannot speak confidently at present on pneumonia as seen in them. Our one Maori, aged 23, died on the eighth day. A Fiji Islander was a rather remarkable case of lobar pneumonia, for he had high continued fever of 103° F. or more until the sixteenth day, when recovery by crisis occurred.

Month.—Five cases of lobar pneumonia, which had been admitted in December, 1916, were still in the ward in January, 1917, when our series begins. Seven cases of lobar pneumonia were admitted in the month of January and there were two deaths during this month. February was the heaviest month with 17 admissions and 6 deaths; March, 12 admissions and 3 deaths; April, 10 admissions and 2 deaths; May, 8 admissions and 2 deaths; June, 5 admissions and 2 deaths. During the first half of July there was one admission and no death.

Age.—Eight of our patients were below 20 years of age and none of these died. Between the ages of 20 and 29 there were twenty-six cases with a mortality of five, i.e., 19·2 per cent. Of those aged between 30 and 39, sixteen patients were admitted and five died, a mortality of 31·2 per cent. Fourteen of these cases of lobar pneumonia were from 40 to 49 years of age and six ended fatally, i.e., a mortality of 42·8 per cent. One patient who died was 59 years of age. We had no other cases above 50 years of age. The mortality, in all patients treated, was seventeen in sixty-five, i.e., 26·1 per cent. As we shall point out below, thirteen of these seventeen cases showed bilateral involvement.

Local or Convoy Admissions.—Thirty-eight of our cases were local admissions, and of these nine died, a mortality of 23·6 per cent. The mortality in cases admitted by convoy, i.e., from the Front, was considerably higher, twenty-seven cases with eight deaths, a mortality of 29·6 per cent. When we hold that it is wrong even to allow a patient suffering from pneumonia to exert himself in bed, and when we consider the fatigue which must be caused by a railway journey and ride in an ambulance, then the contrast in the percentages given above is as we should expect.

The convoy patients were admitted with a variety of diagnoses, but those of "pleurisy" or "pleurisy ? pneumonia" were the most frequent. Some were sent to us diagnosed "pneumonia." Other diagnoses were "bronchitis," "P.U.O." (pyrexia of uncertain origin), "D.A.H." (disordered action of the heart), "D.A.H. and P.U.O.," "influenza," "laryngitis," and "debility." All this, we think, goes to show the difficulties, due to rush of work, with which the medical officers at Front area hospitals have to contend. At the same time, we feel that if at the Front there is a strong suspicion that the case is one of pneumonia the patient should not be sent to the base whilst the disease is beginning, is at its height, or is in the early convalescent stage. A grave mistake was made in sending down on the seventh day, with the diagnosis of "pneumonia," a patient whose illness had been characterized at its onset by "pain in the right upper chest, cough, rusty sputum." He was extremely ill on his arrival, and died twenty-four hours after his admission to our hospital.

Field Service.—In contrast with "Total Service" this means service with the Expeditionary Force, and in the fatal cases it varied from one day to two and a half years. Our figures do not show that the percentage of deaths in lobar pneumonia increases with the length of stay of the soldiers in France.

Previous History.—Three of the fatal cases were in-patients who had suffered

from pneumonia before; three confessed that they had been alcoholics; three stated that they had often been troubled with bronchitis and asthma; and two had had malaria. One of these latter had been through the South African War, but did not know that he had contracted the disease there, although his history subsequent to that period warranted us in concluding that he had. Chills and "spikes of fever" made us suspicious during the course of his disease, and the organisms of tertian malaria were found in his blood. This war has abundantly proved that in persons who have suffered from malaria the disease may reappear during an acute illness, after a fracture of one of the bones, or even after slight wounds. Vandenbosche[1] has studied this question at Salonica.

Onset.—The mode of onset in these fatal cases did not differ in any striking way from that which one expects to find in lobar pneumonia. It is a disease which may attack one at any time or in any place, and it is not surprising that amongst our patients there was a soldier who was taken ill whilst on leave in England, and on the point of returning. He reported sick on his arrival in France. Another man had been for about two weeks in one of the medical wards suffering from sore throat, slight cough, headache, general aches and pains, and anorexia. His temperature had been normal or sub-normal when one day he suddenly had a severe chill, and his temperature rose to 103·7° F. He died of a very extensive bilateral lobar pneumonia.

Clinical Course.

Herpes.—There are some who consider that the presence of this lesion warrants a favourable prognosis. In our series such a conclusion cannot be drawn; of the 48 living cases herpes was noted in 8, and in the 17 fatal ones our records show that it occurred 5 times. In one instance herpes did not appear until the seventh, and the patient died on the eighth day of disease.

Temperature.—Ten of the seventeen fatal cases had high continued fever. The others showed marked remissions, and these generally coincident with the spread of the disease to another lobe. The chart of the case complicated by malaria was an interesting one. Chills began on the seventeenth (?) day of disease, and with the first one his temperature rose to 105° F. After quinine had been given for several days the chart was of the septic type. As dullness and blowing breathing persisted, and as the fluoroscope showed a dense shadow, which apparently lay between the middle and upper lobes, interlobar empyema was suspected. The needle and syringe, however, failed to find pus. No heart murmurs were made out. The autopsy showed a band of unresolved pneumonia in the right upper lobe. This area of consolidation occupied the position of the shadow seen in the fluoroscope, and had been interpreted as an interlobar empyema. However, no pus was found, nor was there any fissure at this site, as the middle lobe was absent. There was acute ulcerative endocarditis of the aortic valve. Other "atypical" charts were seen in the two cases operated upon for empyema. In the first, the temperature had gradually fallen from 103° F. to normal on the thirteenth day, but rose on the fourteenth to 103° F. again, and remained between this level and 100° F. until death on the twenty-ninth day. We failed to find pus with the needle on the seventeenth, nineteenth and twenty-

[1] *Journ. de Méd. et de Chir. prat.*, April 25, 1917.

first days; but succeeded in doing so on the twenty-third. A rib was resected on the following day, and the cavity well drained. The patient was transferred to a surgical ward. At the autopsy no "pocketing" of pus was found on the side (right) operated upon, but unresolved pneumonia of the whole of this lung. Whilst there was no pneumonia on the opposite side, we found a large clear pleural effusion which had caused great compression of the lower lobe. The second patient with empyema had had high continued fever with a maximum of 105° F. and a minimum of 100° F. The disease was extensive, there were no chills, and for a time empyema was not thought to be present. The chest was explored with a needle on the fourteenth day, and merely blood from the lung recovered; but on the eighteenth day, on tapping the thorax at a different site on the same side, fifteen ounces of turbid fluid were withdrawn. A smear of this showed pneumococci. A rib was resected on the same day, and a large cavity drained. The patient died on the nineteenth day, and the post-mortem examination showed delayed resolution and some organization of the lung on the same side which had been operated upon. There were 1½ pints of turbid fluid on the opposite side which contained very many pneumococci. Here the left lower lobe was represented by a tiny lappet, and practically the whole lung, except for a small part at the apex, was consolidated. The disease was even more extensive than was thought.

Extent of Disease.—A striking feature of our cases has been the number in which both lungs were affected. Thirteen out of seventeen showed this. It is a higher proportion than we have found in a large series of post-mortems in Canada, and is still being maintained, as the only three autopsies, done upon cases of lobar pneumonia since our present series was closed, have shown the same condition. In 100 post-mortems performed at the Montreal General Hospital, Osler reported only seventeen cases with disease of both lungs. In one of our cases the lesion on the opposite side was not diagnosed during life, and this was in a prolonged case of unresolved pneumonia complicated by malaria and endocarditis as we have referred to above. Here broncho-pneumonia of both lower lobes was found post mortem. In four cases the pneumonia was bilateral on admission to hospital. Extension of the disease to another lobe of the same lung, or to the other lung, was often accompanied by fresh pleuritic pain, the appearance of bright red blood in the sputum, and by signs of consolidation. When an exact date was noted in these cases this spreading of the disease took place generally about the sixth day. In four cases it was found at autopsy that the pneumonia, noted on the opposite side to that of the original lesion, was of confluent lobular, and not lobar, distribution. It is quite commonly observed clinically in cases of lobar pneumonia that the blowing breathing and other signs of consolidation appear in the course of the disease in the contiguous part of the neighbouring lobe. In our series of autopsies we saw five examples of this paradox of lobar pneumonia; that is, sharply defined and firm consolidation, lobar in nature, of only part of a lobe, whilst the remainder was quite free to the naked eye from any disease. A satisfactory explanation of this phenomenon has never yet been given as far as we know. It is possible that infection may take place where the endothelial cells covering contiguous surfaces of the pleura have been injured or destroyed by the pleurisy which is always present. Very often too, as may also be demonstrated during life in an ordinary case of lobar

pneumonia, we found that a narrow margin at the anterior border of the lobe showed no consolidation, so that the pneumonia was not "lobar" in the strict sense of the word.

Delirium.—This was not a troublesome factor with which to contend. It was noted in eight of the seventeen fatal cases, and in only one was it very marked. We have not yet drawn off cerebrospinal fluid to relieve this symptom, as has recently been recommended by Musser and Hafford.[1]

Extra-systoles.—It has often been pointed out that extra-systoles may disappear during the course of an acute disease, accompanied by high fever. We had the opportunity of noting this phenomenon in the case of a man, aged 48, who, when admitted, had marked extra-systoles, but in the course of a few days the heart and pulse became quite regular. Unfortunately we were unable to see the extra-systoles return as the patient died.

Immediate Cause of Death.—Practically all the seventeen cases died with evidence of failure of the right side of the heart, and after death the chambers on this side of the organ were found to be dilated. Only one of the cases died of the toxic effects on the respiratory centre, and contrary to that which was noted at the time of death of all the others, the respirations ceased an appreciable interval of time before the beating of the heart. Before death there had been no cyanosis. The patient was 25 years of age, and died on the fifth day of disease. The post-mortem examination revealed early grey hepatization of all the lobes except the left upper one. There was no dilatation of the heart. By coincidence this picture stood out in sharp contrast with the usual findings, as at the same time we did an autopsy upon the body of a man, aged 48, who died of failure of the heart on the tenth day of disease, and who was markedly cyanotic before death. There was very extensive disease of both lungs in this case, and we estimated that the patient could not have used more than one-seventh or one-eighth of his lungs for breathing. The right side of his heart was greatly dilated, and filled with post-mortem clot.

Duration of Disease.—There is nothing very remarkable to note in the duration of the disease in these fatal cases. However, in 1916, we performed an autopsy on a British West Indian who had died ten hours after a typical onset of lobar pneumonia. He had been engaged in hard manual labour close to the hospital, and was brought in direct. His lungs were a beautiful example of red hepatization. In the series under consideration one died on the fifth day, and one on the sixth day of illness. Four died on the seventh, five on the eighth, and two on the tenth day. Two patients were operated upon for empyema, and these died on the ninteenth and twenty-ninth days respectively. One patient died about the twenty-second day (the date of onset was obscure).

At the autopsy there was found lobar pneumonia of the whole of the left lung with beginning resolution, and also a mass of broncho-pneumonia in the right lower lobe. This patient had had septicæmia, and a mural thrombus was found in the right ventricle, but no signs of infarct in the lung could be made out. And finally, one case died on the twenty-ninth (?) day. This patient had unresolved pneumonia, complicated by malaria and ulcerated endocarditis, as described above.

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[1] *Journ. Amer. Med. Assoc.*, 1917, lxviii, p. 1231.

COMPLICATIONS.

Diarrhœa.—Not infrequently the patients in the various wards of the hospital have been troubled with diarrhœa, the cause of which has evaded the keen search of the Sanitary Officer. Along with other patients those in the "Pneumonia Hut" were attacked, and the treatment of three of the fatal cases was made more difficult on account of this disorder.

Malaria.—One patient, to whom we have already referred, had malaria.

Empyema.—In the sixty-five cases of lobar pneumonia empyema was diagnosed three times. All these patients were operated upon; one recovered and the other two died. One of these latter had pus in both pleural cavities. These two cases have been dealt with already, when we were describing those fatal cases which had atypical temperature charts. It is satisfactory to note that no patients died with the complication of empyema undiagnosed.

Pericarditis.—This occurred three times, but was diagnosed in one case only, that of a soldier aged 27. On the seventh day of disease, a to-and-fro friction, synchronous with the movements of the heart, was made out. It was heard at the base of the heart, but best in the second intercostal space immediately to the right of the sternum. He died on the eighth day and the pericardial sac contained a recent fibrinous exudate, and a slight increase in the amount of fluid.

Endocarditis.—Acute endocarditis occurred twice in the seventeen fatal cases, but was not diagnosed clinically. One instance has been described already in the patient who had malaria. The lesion was of the ulcerative type, and situated upon the aortic valve. No murmurs had been heard during life, although these were faithfully sought after. The spleen showed two infarcts. The other case showing this complication was in a man, aged 40, who was large and plethoric-looking, and confessed to an alcoholic history. He was admitted on the eighth day of disease, and a loud to-and-fro murmur was heard at the base of the heart, at the root of the neck, and in the epigastrium, but best heard over the second and third right intercostal spaces. He did not have a "water-hammer" pulse. There was no mitral murmur. The murmurs were attributed to old lesions of the aortic valve (probably syphilitic), and although the heart was listened to carefully on several occasions no change in murmur was made out, and no pericardial friction detected. The man died of cardiac failure on the tenth day of disease. His fever had been continuous between 102° and 104°. At the autopsy we found acute fibrinous pericarditis, with a very small amount of exudate and effusion. The right side of the heart was dilated, and the left ventricle hypertrophied. There was extensive destruction of the aortic valve, especially at the base of the cusps, and the recent vegetations were large. The injury to the heart muscle varied in extent, but in the interventricular septum the ulcerative process had extended right through, and a small granular area of necrosis was seen on the inner wall of the right ventricle. Pneumococci were grown from the vegetation. There was the typical "wash-leather" appearance of syphilitic aortitis with aneurismal dilatations, and also sclerosis of the aortic cusps at their bases. Therefore, as is often the case, the acute had been grafted upon a healed endocarditis. Blood was recovered post mortem and the Wassermann test, carried out by our colleague, Captain R. H. Malone, proved positive. In speaking of endocarditis as a complication we must refer to the case with mural thrombus which

has already been described. In the cases which recovered we have not sufficient evidence that any of them suffered from endocarditis.

Jaundice.—Marked generalized jaundice occurred only once, although "icteroid sclerotics" were noted several times. It is not without interest to record, in confirmation with the general finding that this complication is more frequent in the deeply pigmented races, that our case was in a Maori, aged 27. By the fifth day jaundice had become very deep. His temperature remained almost continuously at 104°, and he died on the eighth day of disease. At the post-mortem examination signs of a profound toxæmia were present as evidenced by punctate hæmorrhages beneath the pericardium. The jaundice was quite general, and nothing was seen suggesting obstruction in the bile-ducts or duodenum. The spleen was not enlarged.

Treatment.

The patients were all given fresh air, light nourishing diet, and abundance of fluids. Magnesium sulphate was prescribed every morning unless contra-indicated. Otherwise, the treatment was mainly symptomatic. In the early stages of the disease we did not hesitate to give morphia $\frac{1}{4}$ grain with atropine $\frac{1}{150}$ grain hypodermically to allay pain and induce sleep. Tympanites, always such a troublesome and serious symptom, was treated with turpentine stupes and turpentine enemata, and on rare occasions with turpentine by mouth. As stimulants, strychnine, adrenalin, oil of camphor and digitalin were used, but generally with apparently little effect. When signs and symptoms suggested a possible empyema we always tapped the thoracic cavity, even several times. No apology is made for including this exploratory measure under the heading of Treatment.

NOTES ON A SERIES OF ONE HUNDRED AND SIXTY-ONE CASES OF GUNSHOT WOUNDS OF THE HEAD TREATED AT No. 7 GENERAL HOSPITAL, MAY TO AUGUST, 1916.

By Captains W. W. WAGSTAFFE and W. J. ADIE.
Royal Army Medical Corps.

CONTENTS.

Additional Note by Colonel C. Wallace, C.M.G., A.M.S.

As the result of the D.G.M.S.'s permission to treat head wounds arising in the First Army area at No. 7 General Hospital, the D.M.S. First Army, issued instructions to commanding officers of the casualty clearing stations, permitting them to send on such cases by car to No. 7 General Hospital.

The type of case sent on has been that in which operation seemed likely to be of benefit, namely, those cases with slow pulses. They have been of all degrees of severity. Cases with rapid pulses have not, as a rule, been sent back, as such cases usually are not worth submitting to operation.

I have satisfied myself that the cases have stood the journey well, as I have seen them in the casualty clearing stations and on arrival at No. 7 General Hospital.

No. 7 General has also received by barge cases operated on in the same casualty clearing stations that have sent cases back before operation. It has been therefore possible to compare the results obtained by operation at the "Front" and "Base," and as the cases have been practically of the same severity the comparison is a fair one.

In making the comparison it is of course necessary to remember that the cases received by barge are the survivors of the cases operated on at the casualty clearing stations, a certain amount of elimination by death having already taken place. One would therefore expect the mortality of those operated on at No. 7 General to be larger than those received by barge. As a matter of fact it is about two per cent heavier. If, however, the cases dying within two days (head cases are kept, as a rule, much longer than at the casualty clearing stations before transfer) of operation at No. 7 General are taken out, the mortality is much in favour of those transferred before operation, and the difference will cover any error due to the fact that the type of case operated on at the casualty clearing stations might be more severe than those operated on at No. 7 General, owing to the medical officers at the casualty clearing stations giving unfavourable rapid pulse cases the chance of operation interference.

The experiment can, I think, be said to be very successful. It avoids the necessity of transferring such cases at a time when they travel badly, and the beneficial effects of perfect quiet after operation are shown by the absence of secondary complication, as is pointed out by Captains Wagstaffe and Adie. I may point out that I have frequently received reports of head cases arriving at the sea bases in bad condition, which cases have left the casualty clearing stations in "good condition."

It might be said that the experiment shows that head cases might be transferred to the sea bases before operation, but this necessitates considerable delay in clearing up the lines even when trains are running every day, but when in "peace times" the trains evacuate only at two or four days' interval, the delay is too long to be risked.

It seems that it would be worth while establishing in each Army Area some hospital within reasonable distance of the front, to which head cases can be transferred, and where they will have the benefit of X-ray examination, reasonably early operation and complete rest until ready for transference to England. The type of operation is as follows:—

Excision of scalp wounds.
Cutting away bone to show about half an inch of uninjured dura.
No deep search for the projectile.
Covering in the exposed brain by the scalp (wounds one flap external).
A short period of drainage by tubes through the angle of the flap.
The brain has only been drained in exceptional cases.

I.—Origin of Cases.

On May 24, 1916, the first cases of gunshot wounds of the head arrived at No. 7 General Hospital. Since then a total of 161 have been treated. These cases have been derived from the First Army Area and have been brought to No. 7 General Hospital by one of two methods of transport:—

(*a*) *Motor Ambulance.*—These cases are brought direct from the casualty clearing stations without operation. The period of transit from the casualty clearing station here is on an average two hours, and they usually reach here within twenty-four hours of being wounded.

(*b*) *Barge.*—These cases are brought from the casualty clearing stations where they have usually been operated on. The period of transit from the casualty clearing station here is on an average twenty-four hours, and they are moved at a variable period after operation.

In considering the results of the treatment of these cases we shall find it convenient to divide them into two classes: (*a*) not operated on before admission, (*b*) operated on before admission, and to consider certain points which arise in connexion with this essential difference.

II.—Numbers.

The subjoined Table "A" gives a rough analysis of the cases on which this report is based:—

TABLE "A."

(1) Total number of cases of injury to skull:—		
(*a*) Not operated on before admission	100	
(*b*) Operated on before admission	36	
		136
(2) Total number of cases of scalp wounds necessitating operation..		25
		161
(3) Total number of cases trephined:—		
(*a*) Operated on at No. 7 General Hospital	89	
(*b*) Operated on before admission	34	
		123

III.—Detailed Consideration of Cases not operated on before Admission.

These cases have been of all degrees of severity, and were selected by the casualty clearing stations as being capable of standing the journey of two hours. They have included a large number of cases whose condition was very bad, and while it is difficult in the majority of cases to appreciate the exact condition in which the patients left the clearing stations it can be said that they all, even those most seriously wounded, stood the journey remarkably well and in no single case can it be said that the journey either caused death, or decreased in any way, so far as clinical evidence is capable of showing, their chance of recovery. In no case was a sudden exacerbation of symptoms noted on the journey, and in all cases where the condition on leaving the clearing station was accurately reported, the condition on admission showed no appreciable deterioration. One case died before admission. This man had extensive cerebral and cerebellar laceration.

In considering these cases in detail it will be well to give a table showing the classification of the cases.

TABLE "B."—GUNSHOT WOUNDS OF HEAD WITH INJURY TO SKULL OPERATED ON AT NO. 7 GENERAL HOSPITAL.

(1) Penetrating wound of dura :—		
	Total number	73
	Discharges from hospital to England	32
	Under treatment: (*a*) Satisfactory	7
	(*b*) Critical	9
	Deaths	25 (34 per cent)
(2) Non-penetrating wound; skull fractured :—		
	Total number	27
	Discharges from hospital to England	22
	Under treatment: (*a*) Satisfactory	3
	(*b*) Critical	0
	Deaths	2 (7·4 per cent)
(3) Totals :—		
	Total number	100
	Deaths	27 (27 per cent)

(*a*) *Deaths.*—In this Table the most striking feature is the large proportion of deaths in the case of Class 1, penetrating wounds of dura. Let us therefore examine these deaths and their causes as shown by the post-mortem examinations :—

TABLE "C."—DEATHS OF CASES OPERATED ON AT NO. 7 GENERAL HOSPITAL—PENETRATING WOUNDS OF DURA.

Serial No.	Name	Death days after wound	Cause of death
6	W.	1	Cerebral and cerebellar laceration
1	H.	1	Cerebral œdema
74	S.	1	Brain laceration; hæmorrhage third ventricle
91	B.	1	Cerebral and cerebellar laceration, lateral ventricle involved
99	F.	1	Cerebral laceration, lateral ventricle involved
134	C.	1	,, ,, ,, ,, ,,
167	P.	1	,, ,, ,, ,, ,,
179	McD.	1	,, ,, ,, ,, ,,
30	P.	2	,, ,, ,, ,, ,,
43	D.	2	,, ,, ,, ,, ,,
53	S.	2	,, ,, ,, ,, ,,
73	C.	2	Right lateral ventricle involved
132	H.	2	Cerebral laceration, lateral ventricle involved
146	W.	4	Hæmorrhage, subdural, in posterior fossa and spinal cord
18	C.	5	Brain laceration, purulent basal meningitis
10	R.	6	Brain laceration, pneumonia
99	B.	7	Cerebral laceration, lateral ventricle involved
133	S.	10	Purulent basal meningitis
119	L.	11	Cerebral laceration, lateral ventricle involved
90	B.	12	Purulent basal meningitis
106	S.	12	Cerebral laceration, lateral ventricle involved
107	L.	12	,, ,, ,, ,, ,,
83	P.	17	Lateral ventricle involved, cortical meningitis
93	C.	21	Lateral ventricle involved, purulent basal meningitis
82	S.	22	Cerebral laceration, lateral ventricle involved

From this Table we see that a large proportion of the deaths, thirteen out of twenty-five, occurred within forty-eight hours of the time of wounding, and in nearly all of these cases the cause of death was involvement of the lateral

ventricle, accompanied by laceration of the brain. At the post-mortem examination of these cases the ependyma of the lateral ventricle is found to be pierced, and the lateral ventricle cavity and often the other ventricles as well contain lacerated brain matter and blood. This condition appears to be almost uniformly fatal within a comparatively short time. We may take it then that these cases if they had been operated on at a casualty clearing station could never have been transferred down the line, and we may for purposes of comparison with the cases operated on and transferred here, omit these cases in the consideration of our mortality percentage. Table "B" can therefore be modified.

TABLE "D."—GUNSHOT WOUNDS OF HEAD WITH INJURY TO SKULL OPERATED ON AT No. 7 GENERAL HOSPITAL.

(1) Penetrating wound of dura (eliminating deaths within forty-eight hours of arrival) :—		
	Total number	60
	Deaths	12 (20 per cent)
(2) Non-penetrating wound; skull fractured :—		
	Total number	27
	Deaths	2 (7·4 per cent)
(3) Totals :—		
	Total number	87
	Deaths	14 (16 per cent)

As regards the cause of death in those dying in hospital more than forty-eight hours after being admitted, there are certain points of interest.

(1) Cases dying of purulent basal meningitis. Four in number, thirty-three per cent of deaths. We shall see later how this compares with the figures of cases operated on before admission.

(2) Cases dying of cerebral laceration with involvement of the lateral ventricle. In these cases the involvement of the ventricle appears not to have occurred at the time of the injury but later, as a result of changes in the cerebral tissues, and to be as a rule the determining cause of death. In all of them there was a complete absence of basal meningitis.

(*b*) *Recovery.*—In speaking of recovery with reference to these cases, the term is, of course, used in a comparative sense, as the time during which they are under observation is far too small to enable one to form as yet any definite opinion as to the ultimate prognosis. Generally speaking the patients are kept in the hospital until they are able to get up in a chair, a period averaging about six weeks. It is assumed that a patient who can with impunity get up in the ward, will equally with impunity bear the journey to England.

The recovery in the great majority of the cases has been uninterrupted by fits or any sudden exacerbation of symptoms, as the following table will show :—

TABLE "E."—RECOVERIES OF GUNSHOT WOUNDS OF HEAD PENETRATING. OPERATED ON AT No. 7 GENERAL HOSPITAL.

Number of cases discharged to England	32
Uninterrupted progress	28 (87 per cent)
Complications	4
Fits (general)	1
Headache and pyrexia	2
Erysipelas	1

(*c*) *Operation, Technique, Treatment.*—On admission to the hospital the patient has an X-ray taken of his skull, antero-posterior and lateral views, and he

is then sent to the ward. After a rest of from four to twenty-four hours he is operated on. The operation usually performed is of the most conservative type, and consists, in the case of penetrating wounds of the dura, of an excision of the wound, turning down a flap, removing the bone so as to give a margin of at least ¼ inch of healthy dura around the perforation, suturing the excised wound and closing the flap with lateral drainage. In some cases of extensive injury of the brain a drainage tube has been inserted through the excised wound into the brain.

The operation is performed under a general anæsthetic with an injection of morphia, atropine and scopolamine previously. The anæsthetic is in nearly all cases very well taken, and a very small amount is required.

The after treatment consists in maintaining the patients in a condition of perfect quiet. Restlessness is a very common feature and is combated with injections of morphia and atropine. In no case in our experience has the patient proved noisy and refractory to this treatment, and a small ward set apart for the segregation of noisy and refractory patients has only had to be used very rarely, and then only for patients with meningitis in the terminal stages.

The healing of the wounds has been remarkable, and only one case has been discharged to England with a large granulating surface. This patient had a very large hernia cerebri which subsided under repeated lumbar puncture and became well covered with healthy granulation tissue. On discharge there had been no protrusion of the hernia for more than a fortnight.

Urotropine, ten grains four times a day, is administered in all cases of penetrating wound of the dura mater until the temperature has become normal and the patient has ceased to show signs of cerebral injury.

IV.—Detailed Consideration of Cases operated on before Admission.

These cases have been of all degrees of severity, and the extent of the wound has on the average been certainly no worse than in the case of the cases admitted direct without operation.

The following Table gives the numbers of cases received :—

TABLE "F."—Gunshot Wounds of Head with Injury to Skull. Operated on before Admission to No. 7 General Hospital.

(1) Perforating wounds of dura :—	
Total number	32
Discharged from hospital to England	18
Under treatment : (a) Satisfactory	1
(b) Critical	3
Deaths	10 (32·3 per cent)
(2) Non-penetrating wound; skull fractured :—	
Total number	5
Discharged from hospital to England	4
Under treatment : (a) Satisfactory	0
(b) Critical	0
Deaths	1
(3) Totals :—	
Total number	36
Deaths	11 (30·5 per cent)

(a) *Transport.*—The first problem that presented itself was to investigate how far the patients who are moved soon after operation have their chances of recovery diminished in comparison with those who are moved later. The following Table shows the results on this question :—

TABLE "G."—GENERAL ANALYSIS OF CASES OPERATED ON BEFORE ADMISSION TO NO. 7 GENERAL HOSPITAL.

Transferred on days after operation	Number of cases	Died	Recovered: Developed symptoms after admission	Recovered: Developed no symptoms
2nd	4	2	2	—
3rd	1	—	—	1
4th	2	2	—	—
5th	6	—	4	2
6th	3	2	1	—
7th	3	—	3	—
8th	5	1	2	2
9th	2	1	1	—
12th	2	—	—	2
14th	1	—	1	—
15th	1	1	—	—
	30	9	14	7
	1 date unknown	1 date unknown		

No general conclusion is possible from such a small number of figures, but it may be stated generally that those who are moved earliest are worst on arrival.

(*b*) *Deaths.*—The following Table gives an analysis of the causes of death in the case of penetrating head wounds operated on at the casualty clearing stations:—

TABLE "H."—DEATHS OF CASES OF PENETRATING HEAD WOUNDS OPERATED ON BEFORE ADMISSION TO NO. 7 GENERAL HOSPITAL.

Serial No.	Name	Moved days after operation	Died days after operation	Cause of death
79	B.	2	8	Hæmorrhage from lateral sinus
111	C.	2	6	Purulent basal meningitis
42	H.	4	11	,, ,, ,,
101	H.	4	17	Right lateral ventricle involved
26	S.	6	15	Purulent basal meningitis
136	B.	6	19	Cerebral laceration, lateral ventricle involved, meningitis slight
84	F.	8	21	Purulent basal meningitis
100	F.	9	20	? (P.M. not done).
170	M.	15	16	Secondary hæmorrhage
73	O.	?	12 days after admission	Purulent basal meningitis

In this Table the proportion of cases dying of purulent basal meningitis is remarkable—five out of ten—and also it is worthy of note that there is only one case which died of cerebral laceration and involvement of ventricles, with a slight degree of meningitis. This result one must correlate with the effect of the transporting of the patient after operation. The jolting tends to break down the fine adhesions around the wound and the infection tends to gravitate towards the base, whereas in cases where this transporting is not necessary, the infection which is naturally invariably present tends to remain more localized and can be correspondingly more easily dealt with.

(*c*) *Recovery.*—As has been seen in Table "G," the proportion of cases developing symptoms while in the hospital is very high. The following Table shows the character of symptoms developed:—

TABLE "I."—Recovery of Gunshot Wounds of Head, Penetrating, operated on before Admission to No. 7 General Hospital.

Number of cases discharged to England	18	
Uninterrupted recoveries	7	(39 per cent)
Complications	11	
Fits (general)	3	
Fits (local)	2	
Headache and pyrexia	2	
Headache and pyrexia and swelling of brain	3	
Vomiting		

The responsibility for the high proportion of complications must here rest with the transport, and illustrates well the deleterious effect of transport after operation.

V.—Scalp Wounds.

A small number of lacerated scalp wounds have been admitted to the hospital. They were all treated in the same way by excision of wound and suture. If it was impossible to approximate the edges of the wound completely a drainage tube was inserted. Healing was uniformly good, but in two cases suppuration occurred. The healing of all the cases in which a drainage tube was inserted was satisfactory.

TABLE "J."—Scalp Wounds.

(1) *Operated on at No. 7 General Hospital:—*	
Total number	18
Healed by first intention	13
Satisfactory	4
Suppurated	1
(2) *Operated on before admission to No. 7 General Hospital:—*	
Total number	7
Healed by first intention	4
Satisfactory	2
Suppurated	1
(3) *Totals:—*	
Total number	25
Healed by first intention	17
Satisfactory	6
Suppurated	2

In the case of the patients whose wounds suppurated, the suppuration in each case was moderate in degree, and healing was complete in fourteen days. The incisions in nearly all cases were wide, and involved the removal of a large amount of tissue. The saving of time in convalescence was great, but the occurrence of suppuration points to this method being dangerous unless the patient can be kept under observation during the healing of the wound.

VI.—Conclusions.

It will assist us in coming to some conclusion as to the necessity or otherwise of avoiding transport of patients after operations for gunshot wounds of the skull, if we examine a Table which contrasts the results obtained in cases which have not been moved with those which have been moved.

TABLE "K."—RESULTS TABULATED.

GUNSHOT WOUNDS WITH INJURY TO SKULL.

	Cases operated on at No. 7 General Hospital	Cases operated on before admission
Wounds involving Penetration of Dura :—		
Total	75	31
Percentage mortality, total	34 per cent ..	—
Percentage mortality not immediate ..	20 ,, ..	32·5 per cent
Recovery uninterrupted	87 ,, ..	39 ,,
Non-penetrating Wounds ; Skull Fractured :—		
Total	27	5
Percentage mortality	7·4 per cent ..	1 case died
Total :—		
Total number	100	36
Percentage mortality not immediate ..	17·4 per cent ..	30·5 per cent
Percentage mortality, total	27 ,, ..	—

Any conclusions that one may attempt to draw must at best be tentative. The following points may, however, be emphasized :—

(*a*) There is a great advantage in being able to keep patients in one place after operation without the necessity for subjecting them to the serious vibration involved in a journey.

(*b*) Before operation patients stand transport very well, even very seriously wounded cases.

(*c*) The nursing of head cases demands a large number of highly trained attendants.

(*d*) Before operation every case of gunshot wound of the head should be X-rayed.

(*e*) Recovery of function in paralyses, the result of gunshot wounds of the head, is most remarkable.

(*f*) Retention of foreign body in the brain is not immediately and necessarily hurtful. Twenty-three cases of this class have already gone to England from this hospital.

A NOTE ON THE VALUE OF BRILLIANT GREEN AS AN ANTISEPTIC.

BY CAPTAIN C. H. S. WEBB.
Royal Army Medical Corps.

THE comparative novelty of the use of brilliant green as an antiseptic for the dressing of wounds is the excuse I submit for the following notes.

Since May, 1916, I have been using, and observing the effects of, a solution of brilliant green in the treatment of wounds that have passed through my hands at a casualty clearing station.

On the whole I am favourably impressed with the good results obtained from its use.

The brilliant green is dissolved in normal saline solution in the strength of 1 in 1,000. At this strength it can be used as a lotion, and gauze soaked in it can be applied to the wound as a dressing. It is non-irritant to the tissues and

I have applied it to the peritoneum, the meninges, the synovial membranes and practically all other varieties of tissue without harmful effects.

Unlike antiseptics such as perchloride of mercury, it acts as efficiently in the presence of serum as in its absence.

The less vascular tissues are stained green by its use—for instance, the cuticle of the skin, the edges of fascia or aponeurosis, and sometimes bone. But where it has been in contact with the more vascular muscle or subcutaneous tissue, no staining occurs. Dead and necrosed portions of muscle are stained green, and this fact is sometimes of use in distinguishing such necrotic tissue.

After being in contact with the tissue, the dye gradually becomes transformed into a leuco-derivative, and the hitherto green-dyed gauze in contact with the wound becomes white to the depth of several layers.

Granulation tissue rapidly forms in the wound, and to emphasize this statement, I believe that the formation of granulation tissue is more rapid, and more "virile" in character, under the influence of a dressing of brilliant green than with other antiseptics, e.g., eusol.

The most striking results are seen in the cut surfaces of muscle. The muscle rapidly becomes bright red, and the formation of a highly vascular granulation tissue takes place. In thirty-six to forty-eight hours the muscle may be covered with firm "dry" bright red granulation points, which present none of the shreddy, sodden look of the granulations under a eusol dressing.

The surface of the wound is drier, and the pus formation is smaller in amount and thicker in consistency, than in a similar wound dressed with eusol.

At a casualty clearing station it is almost impossible to formulate other than approximate conclusions concerning the merits or demerits of any antiseptic.

The obstacles against obtaining any exact judgment are as follows:—

(1) The cases have been handled before, and other antiseptics have been applied, i.e., at the field ambulance.

(2) The cases do not stay long enough for any extended observation, before being transferred to the base.

(3) Those cases that do stay and on which more lengthy observations can be carried out, are of the more severe type, many having mortal wounds.

(4) The difficulty of obtaining news of the subsequent history of the case after it has left the casualty clearing station.

However, by a method of comparison of selected cases, as nearly as possible similar in nature and extent of injury, it is possible to estimate the relative merits of two or more antiseptics, as judged by clinical standards.

By such means, I have tried to compare brilliant green with eusol and believe that the green is the better antiseptic of the two.

Latterly I have been using the green in conjunction with "salt" tablets.

It has been my experience that the usefulness of the "saline pack" is enhanced by the inclusion of some antiseptic in the dressing. The combination of the "saline pack" with the green solution during the first few days of the wound has, I think, given better results than the use of one or other alone.

It can also be used after the method of Carrel ʒss to ℥j of a 1 in 1,000 solution being syringed down a tube or series of tubes leading into the depths of the wound.

It is not so irritant to the skin edges as the hypochlorite solution.

SUMMARY.

(1) Brilliant green is undoubtedly an active and efficient antiseptic.

(2) It is non-irritant.

(3) It acts well in the presence of serum.

(4) It possesses very definite auxetic properties.

(5) It stains dead tissue green and in this way may aid the surgeon in determining what to excise.

(6) As it is soluble in "saline" it can be used in conjunction with the "salt pack."

(7) It can be used after the method of Carrel.

NOTES ON AN OUTBREAK OF PHLEBOTOMUS FEVER.

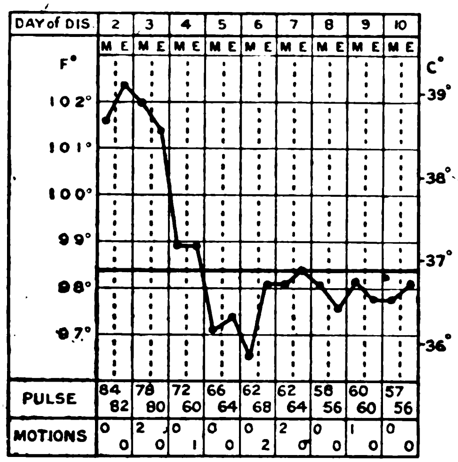
BY CAPTAIN J. A. HARTLEY.
Royal Army Medical Corps (T.F.).

AN outbreak of the above-mentioned fever, which is sometimes referred to as sandfly fever, occurred with a squadron of Yeomanry on outpost duty in mid-Egypt in the middle of summer last year. The post was on the western edge of the cultivation, and the writer was in medical charge of the unit. Of the total strength, 86·4 per cent were infected. The first case was discovered on the thirty-seventh day in occupation and from this there were three or four fresh cases daily for a week, and an average of six daily in the second week. For medical reasons the unit then moved about 1½ miles to a new camp on fresh ground, and although it was impossible to avoid carrying the infection, better conditions followed. For military reasons it was desirable to maintain occupation of the first position and after taking preventive measures, additional to what had already been followed, a guard drawn from another unit was placed in it. Four days had scarcely elapsed, when the N.C.O.s and men who formed this presented symptoms of infection and the illness spread through all of them.

The accommodation consisted of a dwelling house and offices which the officers and N.C.O.s occupied, and shelters constructed of wood and canvas for the men. All were placed compactly on an elevated site adjacent to a pool. This pool covered an area of about an acre and contained more or less stagnant water. Agricultural drains of muddy water were in touch. For all that the sanitary arrangements were satisfactory except for the drinking water which was bad. The latrines and horse lines were at a reasonable distance. Preventive measures were followed in the form of cresol spraying throughout, and the use of paraffin oil on breeding places. Everyone, officers and other ranks, had a mosquito net but this could not be counted on for much, as the midge is so small it can easily pass through the mesh.

The incubation period runs from four to seven days. The onset was very sudden and accompanied with severe malaise, headache, suffusion about the eyes and post-orbital pain; pain in the lumbar region which was generally intense; pains and cramp in the limbs. Constipation nearly always. Profuse sweating. The temperature rose quickly to 102·5° F. or 103° F. As high as 105° F. was noted on a few occasions. After twenty-four hours the pyrexia diminished. It is a "three days fever" and at the end of that period falls to normal. The pulse was not correspondingly acclerated, seldom above 80. It became soft and weak and the cardiac condition required attention.

The suddenness of the onset was the marked feature. A man to all appearance in normal health was at duty at 9 a.m. and an hour later reported ill with giddiness and inability to carry on. His temperature was taken and found to be 103° F.; other symptoms developed in the course of an hour or two. One night another was found on horseback wandering up and down the road unable to recall to mind the way he was accustomed to take to reach camp. He was feeling dazed and ill. His temperature was at the moment taken and found to be 103·2 F. An hour earlier, feeling all right, he had left headquarters of the regiment two miles back from where he was found.



Clinical chart of a case of phlebotomus fever.

In the commencement of the outbreak difficulty was met with in determining what the illness was due to. Phlebotomus fever had not been prevalent nor were contacts from outside found. One or two subjects of malaria were on the strength, many cases of minor septic conditions which might or might not be causing pyrexia, and illness from exposure to heat of the sun had to be taken into account. From dengue the condition is differentiated by the suffused eyes, absence of both rash and the secondary rise in temperature after a few days running normal. In paratyphoid the pyrexia seldom runs so high and has not the characteristic third day drop to normal. Severity of the rigor in malaria and fall of the temperature in a matter of hours distinguish it; enlargement of the spleen is also to be remembered. In influenza implication of the respiratory system is the most frequent accompaniment.

The sandflies were plentiful. They are very small and midge-like, with hairy bodies. Found on walls and in rubble. The breeding places require moisture. The virus is not known.

With regard to incidence, the first to contract the illness were the men, N.C.O.s next and officers last.

Most cases were evacuated to hospital. Those remaining in the lines were kept together apart from the uninfected; had the bowels set working by a purgative and given salicylate of soda, phenacetin or opium for the relief of their pyrexia and aching limbs. Subsequent debility was a marked feature considering the shortness of the acute stage, but many managed to recover sufficiently to return to light duty after fourteen days.

Report.

AN INVESTIGATION INTO THE INCIDENCE OF ALBUMINURIA AND CASTS IN BRITISH SOLDIERS DURING TRAINING AND THE RELATIONSHIP OF THIS CONDITION TO WAR NEPHRITIS

By Captain H. MacLEAN.
Royal Army Medical Corps.

Report to the Committee on War Nephritis.

(The Medical Research Committee provided the services of Captain H. MacLean.)

(*Continued from p.* 255.)

Distribution of Casts in the Different Grades of Albuminuria.

As might be expected, the percentage of albuminuric urines containing casts was highest in those cases where the albuminuria was well marked. Thus, in the 50,000 cases, the percentage of albuminous urines of grades A, B, C, D, containing casts was 44·6, while of grades N, NN, only 20·3 per cent had casts.

Figures for the different groups of 10,000 are given below.

TABLE IX.—Percentage of Albuminuric Cases showing Casts in Different Grades of Albuminuria.

1st 10,000	Grades A, B, C, D,	50 per cent ..	Grades N, NN,	17·1 per cent
2nd ,, ...	,, ,,	50·1 ,, ..	,, ,,	15·7 ,,
3rd ,, ...	,, ,,	37·0 ,, ..	,, ,,	22·6 ,,
4th ,, ...	,, ,,	46·4 ,, ..	,, ,,	24·0 ,,
5th ,, ...	,, ,,	39·5 ,, ..	,, ,,	22·5 ,,

The following Tables (X to XIV) show the number of casts observed in the five different groups of 10,000 men examined. The incidence of epithelial and of hyaline varieties of casts associated with the different grades of albuminuria is indicated. In general, the various figures in the different groups agree fairly well.

TABLE X.—Distribution of Casts in First Group of 10,000 Men Examined.

Grade of albuminuria	Number of cases with epithelial casts	Number of cases with hyaline casts only	Total number of men with casts	Percentage of cases with epithelial casts	Percentage of cases with hyaline casts	Percentage of albuminuric cases showing epithelial casts	Percentage of albuminuric cases showing hyaline casts	Percentage of albuminuric cases showing casts of all kinds
A ..	13	6	12	0·13	0·06	54·2	25·0	79·2
B ..	14	12	26	0·14	0·12	31·1	26·6	57·7
C ..	8	10	18	0·08	0·10	22·2	27·7	49·9
D ..	14	13	27	0·14	0·13	18·6	17·3	35·9
N ..	14	24	38	0·14	0·24	7·5	12·9	20·4
NN ..	12	20	32	0·12	0·20	5·3	8·9	14·2

TABLE XI.—DISTRIBUTION OF CASTS IN SECOND GROUP OF 10,000 MEN EXAMINED.

Grade of albuminuria	Number of cases with epithelial casts	Number of cases with hyaline casts only	Total number of men with casts	Percentage of cases with epithelial casts	Percentage of cases with hyaline casts	Percentage of albuminuric cases showing epithelial casts	Percentage of albuminuric cases showing hyaline casts	Percentage of albuminuric cases showing casts of all kinds
A ..	3	3	6	0·03	0·03	37·5	37·5	75·0
B ..	15	3	18	0·15	0·03	51·7	10·3	62·0
C ..	9	3	12	0·09	0·03	33·3	11·1	44·4
D ..	22	19	41	0 22	0·19	19·4	16·8	36·2
N ..	17	19	36	0·17	0·19	8·8	9·9	18·7
NN ..	22	22	39	0·22	0·17	7·7	6·0	13·7

TABLE XII.—DISTRIBUTION OF CASTS IN THIRD GROUP OF 10,000 MEN EXAMINED.

Grade of albuminuria	Number of cases with epithelial casts	Number of cases with hyaline casts only	Total number of men with casts	Percentage of cases with epithelial casts	Percentage of cases with hyaline casts	Percentage of albuminuric cases showing epithelial casts	Percentage of albuminuric cases showing hyaline casts	Percentage of albuminuric cases showing casts of all kinds
A ..	3	2	5	0·03	0·02	37·5	25·0	62·5
B ..	13	2	15	0·13	0·02	52·0	8·0	60·0
C ..	8	11	19	0 08	0·11	36·1	30·5	66·6
D ..	35	38	73	0·35	0 38	15·0	16·3	31·3
N ..	25	31	56	0·25	0·31	11·7	14·5	26·2
NN ..	16	17	33	0·16	0·17	8·9	9·4	18·3

TABLE XIII.—DISTRIBUTION OF CASTS IN FOURTH GROUP OF 10,000 MEN EXAMINED.

Grade of albuminuria	Number of cases with epithelial casts	Number of cases with hyaline casts only	Total number of men with casts	Percentage of cases with epithelial casts	Percentage of cases with hyaline casts	Percentage of albuminuric cases showing epithelial casts	Percentage of albuminuric cases showing hyaline casts	Percentage of albuminuric cases showing casts of all kinds
A ..	1	—	1	0·01	—	50·0	—	50·0
B ..	12	6	18	0·12	0·06	44·4	23 4	67·8
C ..	12	7	19	0·12	0·07	34·3	20·0	54·3
D ..	37	54	91	0·37	0·54	17·7	25·2	42·9
N ..	18	34	52	0·18	0·34	9·3	17·6	26·9
NN ..	10	22	32	0·10	0·22	6·4	14·1	20·5

TABLE XIV.—DISTRIBUTION OF CASTS IN FIFTH GROUP OF 10,000 MEN EXAMINED.

Grade of albuminuria	Number of cases with epithelial casts	Number of cases with hyaline casts only	Total number of men with casts	Percentage of cases with epithelial casts	Percentage of cases with hyaline casts	Percentage of albuminuric cases showing epithelial casts	Percentage of albuminuric cases showing hyaline casts	Percentage of albuminuric cases showing casts of all kinds
A ..	3	1	4	0·03	0·01	50·0	16·6	66·6
B ..	6	7	13	0 06	0·07	22·2	25·9	48·1
C ..	9	13	22	0 09	0·13	17·3	25·0	42·3
D ..	27	68	95	0·27	0·68	10·6	26 7	37·3
N ..	11	34	45	0·11	0·34	5·6	17·3	22·9
NN ..	9	22	31	0 09	0·22	6·1	15·5	21·6

Some Observations on the Amount and Probable Significance of Casts found in Urines.

In certain of the specimens containing casts only very few casts were actually found. Thus, in the case of the epithelial variety, only one or perhaps two were identified in certain urines, while it was fairly common to have urines showing only two or three hyaline casts. As already stated, the significance of the presence of a very small number of hyaline casts is obscure, and the truth probably is that such findings may in certain cases denote definite pathological changes in the kidneys; in other cases they are of little significance. On the other hand, a urine containing albumin, together with epithelial casts in moderate or large numbers, must be regarded with suspicion, and almost certainly denotes, in the great majority of cases, that the renal tissue is the seat of some inflammatory condition which may be progressive in nature and may ultimately lead to well-defined renal disease.

From this point of view it was of interest to ascertain the number of cases in the 50,000 men examined which gave urines showing albuminuria and large numbers of casts. Naturally, the figures obtained are liable to considerable variation, since the personal factor plays a great part in estimating what is to be considered as "large numbers" of casts. Probably the best method would be to count the casts in a given number of fields of the microscope, having previously taken the necessary precautions for ensuring approximately accurate results. This, unfortunately, was impossible in the present investigation, as the necessary time could not be afforded. An attempt, however, is made in the following tables to indicate as nearly as possible the number of men whose albuminous urines contained casts in sufficient numbers to arouse suspicion. In cases where many hyaline casts were found accompanied by only one or two epithelial, the casts are classified as "hyaline." Epithelial and hyaline casts are estimated separately, and the results found in the different groups of 10,000 men are given. (Tables XVI to XX.)

TABLE XV.—Number of Men in 50,000 Examined whose Albuminous Urines contained Large Numbers of Epithelial or Hyaline Casts.

Epithelial casts in large amount	Hyaline casts in large amount	Total with epithelial and hyaline casts in large amount	Percentage with epithelial casts in large amount	Percentage with hyaline casts in large amount	Total percentage with casts in large amount
271	279	550	0·54	0·56	1·10

General Results.

From Table XV it appears that the total number of men who had albuminuria together with moderate or often large numbers of epithelial or hyaline casts were 550. Of these, 271 had epithelial casts, while in 279 cases the casts were chiefly of the hyaline or hyalo-granular variety. If the results of the examination of the urine for albumin and casts have any significance, it appears certain that the minimum number of men suffering from definite renal deficiency in the 50,000 cases examined was 550. From this it is probable that the "Active Service"

part of the Army contains, during training, at least 1·1 per cent of men whose kidneys are inefficient and who are suffering from some degree of disease more or less marked.

Tables (XVI to XX) showing Number of Albuminuric Urines containing Large Numbers of Epithelial Casts or Hyaline Casts in Different Grades of Albuminuria.

TABLE XVI.—FIRST GROUP OF 10,000 MEN.

Grade of albuminuria	Number of men with epithelial casts in large numbers	Percentage of total men in group with epithelial casts in large numbers	Number of men with hyaline casts in large numbers	Percentage of total men in group with hyaline casts in large numbers
A	13	0·13	4	0·04
B	14	0·14	8	0·08
C	5	0·05	6	0·06
D	10	0·10	8	0·08
N	11	0·11	10	0·10
NN	8	0·08	9	0·09
Total ..	61	0·61	45	0·45

TABLE XVII.—SECOND GROUP OF 10,000 MEN.

Grade of albuminuria	Number of men with epithelial casts in large numbers	Percentage of total men in group with epithelial casts in large numbers	Number of men with hyaline casts in large numbers	Percentage of total men in group with hyaline casts in large numbers
A	3	0·03	4	0·04
B	10	0·10	2	0·02
C	9	0 09	2	0·02
D	15	0·15	6	0·06
N	8	0·08	10	0·10
NN	15	0·15	7	0 07
Total ..	60	0·60	31	0·31

TABLE XVIII.—THIRD GROUP OF 10,000 MEN.

Grade of albuminuria	Number of men with epithelial casts in large numbers	Percentage of total men in group with epithelial casts in large numbers	Number of men with hyaline casts in large numbers	Percentage of total men in group with hyaline casts in large numbers
A	2	0·02	2	0·02
B	9	0·09	6	0·06
C	7	0·07	8	0·08
D	18	0·18	17	0·17
N	15	0·15	10	0·10
NN	11	0·11	11	0·11
Total ..	62	0·62	54	0·54

TABLE XIX.—FOURTH GROUP OF 10,000 MEN.

Grade of albuminuria	Number of men with epithelial casts in large numbers	Percentage of total men in group with epithelial casts in large numbers	Number of men with hyaline casts in large numbers	Percentage of total men in group with hyaline casts in large numbers
A	1	0·01	1	0·01
B	8	0·08	7	0·07
C	8	0·08	7	0·07
D	22	0·22	34	0·34
N	10	0·10	15	0·16
NN	12	0·12	8	0·08
Total ..	61	0·61	73	0·73

TABLE XX.—FIFTH GROUP OF 10,000 MEN.

Grade of albuminuria	Number of men with epithelial casts in large numbers	Percentage of total men in group with epithelial casts in large numbers	Number of men with hyaline casts in large numbers	Percentage of total men in group with hyaline casts in large numbers
A	1	0·01	2	0·02
B	4	0·04	5	0·05
C	5	0·05	8	0·08
D	10	0·10	39	0·39
N	3	0·03	10	0·10
NN	4	0·04	12	0·12
Total ..	27	0·27	76	0·76

Since the total number of men suffering from albuminuria accompanied by casts was 936, this number indicates the maximum number of men who gave any indication of kidney disease as the result of examination of the urine. No doubt many of the urines containing only a few hyaline casts were healthy specimens; but, on the other hand, it is exceedingly probable that certain urines containing a few casts were found negative on examination, as it is not always easy to find casts unless they are present in moderate numbers, when there is, of course, little chance of overlooking them. Since, in some of the cases in which casts were apparently absent, the kidneys were probably not quite normal, one may provisionally accept the view that the specimens of urine containing small numbers of hyaline casts, which were not the result of kidney disease, were balanced by the urines from defective kidneys in which no casts were found.

That the renal tissue may be defective and the urine practically free from casts is proved by the fact that cases of acute nephritis may, on convalescence, show neither albumin nor casts, and yet the kidney efficiency as indicated by the diastatic reaction may be very low.

Taking all these points into consideration, we arrive at the conclusion that at least 1·1 per cent of men on active service are probably suffering from some degree of more or less chronic renal disease, while the maximum number giving any indication of renal deficiency by the ordinary examination is 1·88 per cent.

In round numbers it is possible to state with certainty that not more than two per cent of men give any definite indication of kidney disease, if we allow that kidney disease in general is associated with the presence of albumin and casts in the urine. Fairly definite signs of disease are found in about one per cent of men.

As practically all the men examined had a minimum of four months' training, and the great majority of them had over twelve months, it would appear that the presence of albumin and casts in the urine is no indication that the individual is incapable of severe and prolonged exertion.

(4) The Effect of Sudden Severe Exertion in the Production of Temporary Albuminuria.

It is well recognized that severe exertion, especially when somewhat prolonged, may be followed by the temporary presence of protein in the urine. This albuminuria, however, soon disappears on resting, and, as shown by the observations already discussed in this paper, does not tend to become permanent even after many months of fairly severe muscular exertion.

Only one experiment bearing on this point was carried out in this investigation. A group of 200 men were examined in the usual way after getting up in the morning and again immediately after returning from a course of training which entailed very severe exertion lasting for some hours.

The results bear out the well-known fact that albuminuria may be greatly increased under such circumstances. In this experiment the incidence of total albuminuria rose from 7 per cent in the morning to 14 per cent at night; well-marked albuminuria (A, B, C, D grades) was 2·5 per cent in the morning and 6·5 per cent at night, while the incidence of casts increased from 3 per cent to 6 per cent.

Exact details of the albuminuria are given in the accompanying table:—

TABLE XXI.

Morning. *Results from 200 Men.*

Grade of albuminuria	Number of men
B	1
C	1
D	3
N	3
NN	6
Total	14

Evening. *Results from same 200 Men.*

Grade of albuminuria	Number of men
A	1
B	6
C	3
D	3
N	11
NN	4
Total	28

(5) Incidence of Albuminuria and of Casts in Men of Different Occupations.

In endeavouring to ascertain whether or not any relationship exists between occupation and presence of albumin, many difficulties were encountered. A great number of the men examined had changed their civil occupations recently, and had been engaged, immediately before joining up, on some work directly connected with the War, which, in many cases, had probably little in common with their former occupation.

Again, in order to get reliable results, larger numbers of men than those examined in the present investigation would have to be taken, for the occupations are so diverse that enormous total numbers would be required in order to give a number in each occupation sufficiently large for statistical purposes.

As the problem is one which has no immediate bearing from the military point of view, only one group of 10,000 men was investigated. The comparatively small

number taken was in part due to the enormous labour involved in classifying the different occupations and ascertaining the number of men in each.

As far as possible, the occupations were divided into two groups—those of a more or less sedentary nature and those entailing active physical exertion and often considerable exposure. Such a division is necessarily somewhat artificial, and gives only rough indications, but it does serve in some measure to answer the question whether or not exposure and hard physical labour are detrimental to the kidney.

The results for albuminuria and for casts are given in percentages of the total number of men engaged in each occupation, but it is quite well recognized that the numbers on which these percentages are based are much too small to have any comparative statistical value.

Since it was quite impossible to give all the various occupations mentioned in the group of 10,000 men investigated, the principal ones alone were taken. These were chosen by first ascertaining the occupations which figured most largely in the albuminuria cases in this group. The number of such occupations in the total 10,000 was then estimated.

So far as the numbers go, they give no indication that albuminuria or the presence of casts in the urine is of more frequent occurrence in one occupation than in another; further, no difference is obvious between "Sedentary" and "Active" groups.

The question is, however, complicated by various factors, such as previous disease, age, and length of time during which the individual had been engaged in the particular occupation. It is obvious, for instance, that a boy who had scarlet fever in youth and was suffering from nephritis as the result, would, on choosing an occupation, be more likely to take up tailoring or some such light work rather than that of an ironworker or mason.

The results in the 10,000 men investigated here are recorded in the following tables. Tables XXII and XXIII show the incidence of albuminuria, and Tables XXIV and XXV the incidence of casts. Grades of albuminuria and varieties of casts are indicated.

TABLE XXII.—INCIDENCE OF ALBUMIN IN MEN OF DIFFERENT OCCUPATIONS (Sedentary Occupations without much Exposure).

Occupation	Number of men in each occupation	Number of men in each occupation with albuminuria	Percentage of men in each occupation with albuminuria	Grade of albuminuria					
				A	B	C	D	N	NN
Baker	115	8	7·0	—	—	—	4	1	3
Butcher	112	8	7·1	—	—	—	3	3	2
Clerk	666	36	5·4	—	2	2	19	6	7
Clothworker ..	608	31	5·0	1	2	2	12	6	8
Grocer	201	21	10·4	—	1	—	8	6	6
Packer	70	3	4·3	—	—	1	1	1	—
Printer	83	4	4·8	—	—	2	1	1	—
Shoemaker	137	13	9·5	—	—	—	4	3	6
Shop Assistant ..	82	8	9·7	—	1	—	1	4	2
Steward	57	7	12·3	—	—	1	1	3	2
Student	20	3	15·0	—	—	1	1	1	—
Tailor	158	13	8·2	1	—	1	3	4	4
Warehouseman ..	210	9	4·3	—	—	—	2	4	3

TABLE XXIII.—INCIDENCE OF ALBUMIN IN MEN OF DIFFERENT OCCUPATIONS (Active Occupations with good deal of Exposure).

Occupation	Number of men in each occupation	Number of men in each occupation with albuminuria	Percentage of men in each occupation with albuminuria	Grade of albuminuria					
				A	B	C	D	N	NN
Carpenter	186	15	8·3	—	—	1	4	7	3
Carter	313	21	6·7	1	—	1	6	9	4
Collier	761	68	8·9	—	2	6	24	17	19
Coster	9	3	33·3	—	1	—	1	1	—
Engineman ..	143	12	8·4	—	—	—	5	3	4
Farmers, etc. ..	692	64	9·3	1	2	1	20	24	16
Gardener	131	9	6·8	—	—	—	2	5	2
Horseman	216	15	6·9	—	—	1	4	5	5
Ironworker.. ..	467	29	6·2	1	1	2	7	9	9
Labourer	771	46	9·8	—	2	4	15	14	11
Mason	36	11	30·6	—	2	—	3	2	4
Painter	159	18	11·3	1	2	—	11	2	2
Postman	52	3	5·8	—	—	—	—	2	1
Plumber	52	4	7·7	1	—	—	1	2	—
Railwayman ..	162	10	6·2	—	—	1	6	3	—
Smith	72	11	15·3	—	—	1	3	3	4
Sailor	40	6	15·0	—	—	2	3	1	—

TABLE XXIV.—INCIDENCE OF CASTS IN MEN OF DIFFERENT OCCUPATIONS (Sedentary Occupations without much Exposure).

Occupation	Number of men in each occupation	Number of men in each occupation with casts	Percentage of men in each occupation with casts	Nature of casts	
				Epithelial	Hyaline
Baker..	115	3	2·6	2	1
Butcher	112	2	1·8	1	1
Clerk	666	9	1·3	5	4
Clothworker..	608	12	1·9	5	7
Grocer	201	2	1·0	1	1
Packer	70	2	2·8	2	—
Printer	83	3	3·6	—	3
Shoemaker	137	3	2·2	3	—
Shop Assistant	82	5	6·1	3	2
Steward	57	4	7·0	2	2
Student	20	1	5·0	1	—
Tailor	158	8	5·1	6	2
Warehouseman	210	2	1·0	2	—

TABLE XXV.—Incidence of Casts in Men of Different Occupations (Active Occupations with good deal of Exposure).

Occupation	Number of men in each occupation	Number of men in each occupation with casts	Percentage of men in each occupation with casts	Nature of casts	
				Epithelial	Hyaline
Carpenter	186	5	2·6	2	3
Carter	313	6	1·9	4	2
Collier	761	4	0·5	4	—
Coster	9	1	11·1	—	1
Engineman	143	3	2·1	1	2
Farmers, etc.	692	17	2·4	7	10
Gardener	131	5	3·8	2	3
Horseman	216	3	1·4	—	3
Ironworker	467	7	1·5	5	2
Labourer	771	19	2·5	8	11
Mason	36	2	5·5	2	—
Painter	159	5	3·1	4	1
Postman	52	1	1·9	1	—
Plumber	52	2	3·8	1	1
Railwayman	162	3	1·9	1	2
Smith	72	1	1·4	—	1
Sailor..	40	3	7·5	3	—

(6) Relation of Length of Service to Incidence of Albuminuria and of Casts.

One of the most important features of the present investigation was to ascertain whether or not the general conditions associated with training for active service tended to have a detrimental effect on kidney efficiency as indicated by the ordinary examination. It is almost certain that any appreciably injurious effect on the renal system brought about by training would be indicated by an increase in albuminuria if not in the incidence of casts as well. The longer the soldier had been in training the greater should be the amount of albumin found. The importance of ascertaining definitely the effects of training is obvious, since we have here the total result of many factors, such as exposure, severe exercise, food, etc. If it were found that albuminuria steadily increased with the length of service, it would be necessary to analyse these different factors and find out if possible the particular cause of the condition.

Fortunately, the problem of the relation of training to kidney efficiency no longer presents any difficulty.

Training has no influence whatever either in increasing albuminuria or in causing existing albuminuria to become more marked.

Further, the incidence of casts does not increase with length of training.

The evidence on which these statements are based is supplied in the following tables, in which a fairly complete analysis of the different figures obtained is given.

The men examined were Nos. 3, 4, and 5 groups already referred to, each group consisting of 10,000 men. No account was taken of men with less than three months' service, since the numbers in this category were too small to be of any importance. Owing to this cause, and the fact that it was impossible, in a very few cases, to ascertain the exact period of service, the actual numbers

indicated in each group always fall a little short of 10,000. The total number of men actually examined in this investigation on the effect of training amounted to 29,607. The various tables explain themselves. For each group of approximately 10,000 men the total period of service up to thirty-six months is given. Those with a longer period of service than thirty-six months are grouped together, while, as already stated, the few with two months or under are omitted. The total amount of albumin, as well as the incidence of well-marked albumin and of casts, is given for each period.

Reference to Table XXVI shows that the average number per 1,000 suffering from albuminuria in men of from three to seven months' service was 69. For each successive period of five months the numbers are exceedingly close, being 69, 71, 68, 73, 62, and 61 per 1,000. There is neither an increase nor appreciable decrease of total albuminuria with length of training, but the incidence remains practically constant. This would seem to show that training plays no part in etiology of this albuminuria, and the probability is that the same incidence exists in civil life. This point was investigated at Aldershot, and is referred to later.

TABLE XXVI.—INCIDENCE OF TOTAL ALBUMINURIA, WELL-MARKED ALBUMINURIA (A, B, C, D GRADES), AND OF CASTS IN THREE GROUPS OF MEN AT DIFFERENT PERIODS OF TRAINING. (Total number of men investigated = 29,607.)

Period of training in months, inclusive	Number of men	Total Albuminuria: Average per 1,000, 1st group	2nd group	3rd group	Average	Well-marked Albuminuria: Average per 1,000, 1st group	2nd group	3rd group	Average	Casts: Average per 1,000, 1st group	2nd group	3rd group	Average
3 to 7	4,820	62	68	79	69	27	33	43	34	13	17	43	24
8 to 12	4,121	85	57	66	69	34	30	30	31	31	20	30	27
13 to 17	3,743	82	62	69	71	26	27	37	30	27	23	37	29
18 to 22	3,175	78	53	73	68	38	24	31	31	16	14	31	20
23 to 27	2,875	66	78	77	73	30	39	40	36	20	34	40	31
28 to 32	2,660	64	68	54	62	38	37	32	35	14	22	32	22
33 and over ..	8,213	61	61	61	61	28	28	30	29	18	19	30	22

It might be argued, however, that an increase in the *total* albuminuria might not be expected, since the kidneys which were susceptible to the condition under discussion would have been already injured in the first two months of training before the men came to France. It might also be argued that kidneys which were not affected in the early period of training were not susceptible, and were sufficiently resistant to withstand any injurious factors associated with training.

On this hypothesis an increase in the total albuminuria would not be expected; but, on the other hand, an increase in the severity of the albuminuria in cases already affected would certainly be looked for. The severity of the albuminuria, however, does not increase. Taking the grades A, B, C, D, as indicating well-marked albuminuria, the average numbers exhibiting this degree of albuminuria in successive periods of five months' training are 34, 31, 30, 31, 36, 35 and 29 per 1,000. Here again there is neither increase nor decrease, but a constant incidence.

Apparently, Service conditions neither originate albuminuria to any appreciable extent nor do they aggravate already existing albuminuria.

Further, the number of urines containing casts remain practically constant during training, the figures for successive periods of five months being 24, 27, 29, 20, 31, 22, and 22 per 1,000.

These results give a final answer to the question of the effect of severe conditions, as seen during training on the incidence of albuminuria and of casts.

It appears fairly certain that training is not responsible for the production of any injurious renal effects, for if training entailed conditions actually detrimental to the kidney, one would, at least, expect some increase in the severity of pre-existing albuminuria.

TABLE XXVII.—Relation of Length of Service to Total Albuminuria in Third Group of 10,000 Men.

Length of service in months	Number of men with albuminuria in given period of service	Total number of men with given period of service	Percentage with albuminuria after given period of service
3	26	458	5·7
4	46	802	5·7
5	18	333	5·4
6	28	365	7·7
7	16	200	8·0
8	14	164	8·5
9	9	178	5·0
10	33	359	9·4
11	23	251	9·1
12	42	429	10·2
13	12	215	5·5
14	29	325	8·9
15	24	233	10·3
16	16	230	6·9
17	17	184	9·2
18	32	411	7·7
19	12	135	8·8
20	17	231	7·3
21	12	146	8·2
22	9	123	7·3
23	4	62	6·4
24	35	494	7·1
25	4	59	6·7
26	5	95	5·2
27	7	119	5·9
28	8	83	9·6
29	5	62	8·1
30	23	338	6·8
31	8	137	5·8
32	11	233	4·7
33	11	211	5·2
34	15	250	6·0
35	22	271	8·1
36	52	690	7·5
37 and over	44	786	5·6

No doubt, after severe and sudden exertion protein does appear in the urine. as indicated in Table XXI, but it seems to be a merely transitory phenomenon which soon disappears on resting; it does not appear to exhibit any tendency to become permanent even after thirty-six months or more of training. Pre-existing albuminuria, also, may be aggravated after severe exercise, but the fact that severe albuminuria is not more common after thirty-six months' service than it

is after three months, indicates that in these cases as well this increase is transitory; on resting, the albuminuria soon returns to its old level.

Various other considerations which have an important bearing on the question from the clinical standpoint might be discussed, but are deferred to a future occasion.

Tables XXVII to XXXI deal with the third group of 10,000 men mentioned at an early part of this paper. They indicate the total albuminuria and well-marked albuminuria for each month of service; also the number of urines found to contain casts and the incidence of albuminuria and of casts for periods of five months' service.

Tables XXXII to XXXVI deal with the fourth group, and Tables XXXVII to XL with the fifth group of 10,000 men.

The closeness of the corresponding figures in each group is striking and definitely shows that the investigation was on a sufficiently large scale to give reliable results.

TABLE XXVIII.—RELATION OF LENGTH OF SERVICE TO WELL-MARKED ALBUMINURIA (A, B, C, D GRADES) IN THIRD GROUP OF 10,000 MEN.

Length of service in months	Number of men with well-marked albuminuria (A, B, C, D grades) in given period of service	Total number of men with given period of service	Percentage with well-marked albuminuria (A, B, C, D grades) after given period of service
3	10	458	2·2
4	23	802	2·8
5	8	333	2·4
6	13	365	3·6
7	5	200	2·5
8	7	164	4·2
9	7	178	4·0
10	9	359	2·5
11	12	251	4·7
12	13	429	3·0
13	3	215	1·4
14	9	325	2·8
15	8	233	3·5
16	5	230	2·2
17	6	184	3·2
18	15	411	3·6
19	8	135	5·9
20	7	231	3·0
21	5	146	3·4
22	5	123	4·0
23	1	62	1·6
24	13	494	2·6
25	2	59	3·4
26	4	95	4·2
27	5	119	4·2
28	4	83	4·8
29	5	62	8·0
30	14	338	4·1
31	4	137	2·9
32	5	233	2·1
33	6	211	2·8
34	5	260	2·5
35	9	271	3·3
36	26	690	3·8
37 and over	17	786	2·1

TABLE XXIX.—Incidence of Total Albuminuria and of Well-marked Albuminuria (A, B, C, D Grades) in Third Group of 10,000 Men for each Successive Period of Five Months' Training.

Period of training	Number of men in each period	Total Albuminuria: Total number of men suffering from albuminuria of all grades in each period	Total Albuminuria: Average per 1,000	Well-marked Albuminuria: Total number of men suffering from well-marked albuminuria (A, B, C, D grades) in each period	Well-marked Albuminuria: Average per 1,000
3 to 7 months inclusive	2,158	134	62	59	27
8 ,, 12 ,, ,,	1,381	121	85	48	34
13 ,, 17 ,, ,,	1,187	98	82	31	26
18 ,, 22 ,, ,,	1,046	82	78	40	38
23 ,, 27 ,, ,,	829	55	66	25	30
28 ,, 32 ,, ,,	853	55	64	32	38
33 ,, 37 ,, and over	2,208	144	61	63	28

TABLE XXX.—Relation of Length of Service to Presence of Albumin and Casts in Third Group of 10,000 Men Examined.

Length of service in months	Total number of men with given period of service	Number with casts: Epithelial	Number with casts: Hyaline	Average with casts per 1,000
3	458	3	5	17
4	802	2	1	4
5	333	5	1	18
6	365	6	2	22
7	200	2	1	20
8	164	3	3	4
9	178	4	—	36
10	359	2	6	22
11	251	4	5	36
12	429	7	9	37
13	215	4	2	28
14	325	5	2	21
15	233	5	3	34
16	230	2	3	21
17	184	3	3	32
18	411	5	5	24
19	135	2	—	15
20	231	—	1	5
21	146	2	2	27
22	123	—	—	—
23	62	—	1	16
24	494	4	8	24
25	59	1	—	17
26	95	1	—	1
27	119	1	1	2
28	83	—	2	17
29	62	—	1	16
30	338	4	3	20
31	137	—	—	—
32	233	1	1	8
33	211	2	3	23
34	250	1	1	8
35	271	2	4	22
36	690	5	9	20
37 and over	786	1	12	17

TABLE XXXI.—INCIDENCE OF CASTS IN THIRD GROUP OF 10,000 MEN FOR EACH SUCCESSIVE PERIOD OF FIVE MONTHS' TRAINING.

Period of training	Number of men in each period	Number of men with casts in each period	Average per 1,000
3 to 7 months inclusive ..	2,158	28	13
8 ,, 12 ,, ,, ..	1,381	43	31
13 ,, 17 ,, ,, ..	1,187	32	27
18 ,, 22 ,, ,, ..	1,046	17	16
23 ,, 27 ,, ,, ..	829	17	20
28 ,, 32 ,, ,, ..	853	12	14
33 ,, 37 ,, and over ..	2,208	40	18

TABLE XXXII.—RELATION OF LENGTH OF SERVICE TO TOTAL ALBUMINURIA IN FOURTH GROUP OF 10,000 MEN.

Length of service in months	Number of men with albuminuria in given period of service	Total number of men with given period of service	Percentage with albuminuria after given period of service
3	13	221	5·9
4	19	295	6·3
5	15	199	7·5
6	27	325	8·3
7	14	258	5·4
8	13	217	6·0
9	13	182	7·1
10	15	274	5·5
11	15	253	5·9
12	21	434	4·8
13	7	193	3·6
14	23	314	7·3
15	18	330	5·5
16	27	297	9·1
17	8	202	4·0
18	20	410	4·9
19	11	165	6·6
20	15	199	7·5
21	8	172	4·6
22	7	214	3·2
23	7	107	6·6
24	44	583	7·5
25	3	77	4·0
26	11	109	10·0
27	16	156	10·0
28	10	151	6·6
29	6	91	6·6
30	28	336	8·3
31	9	113	8·0
32	8	199	4·0
33	17	169	10·0
34	16	216	7·4
35	7	160	4·4
36	66	1,303	5·0
37 and over	71	1,047	6·8

TABLE XXXIII.—RELATION OF LENGTH OF SERVICE TO WELL-MARKED ALBUMINURIA (A, B, C, D GRADES) IN FOURTH GROUP OF 10,000 MEN.

Length of service in months	Number of men with well-marked albuminuria (A, B, C, D grades) in given period of service	Total number of men with given period of service	Percentage with well-marked albuminuria (A, B, C, D grades) after given period of service
3	7	221	3·1
4	9	295	3·0
5	6	199	3·0
6	13	325	4·0
7	8	258	3·1
8	9	217	4·1
9	4	182	2·2
10	6	274	2·2
11	11	253	4·3
12	11	434	2·5
13	3	193	1·5
14	9	314	2·9
15	11	330	3·3
16	10	297	3·4
17	3	202	1·5
18	11	410	2·7
19	3	165	1·8
20	7	199	3·5
21	4	172	2·3
22	3	214	1·4
23	2	107	1·9
24	25	583	4·3
25	3	77	4·0
26	3	109	2·8
27	8	156	5·1
28	6	151	3·8
29	2	91	2·2
30	17	336	5·0
31	5	113	4·4
32	3	199	1·5
33	9	169	5·3
34	5	216	2·3
35	3	160	1·9
36	28	1,303	2·1
37 and over	35	1,047	3·3

TABLE XXXIV.—INCIDENCE OF TOTAL ALBUMINURIA AND OF WELL-MARKED ALBUMINURIA (A, B, C, D GRADES) IN FOURTH GROUP OF 10,000 MEN FOR EACH SUCCESSIVE PERIOD OF FIVE MONTHS' TRAINING.

Period of training	Number of men in each period	Total Albuminuria		Well-marked Albuminuria	
		Total number of men suffering from albuminuria of all grades in each period	Average per 1,000	Total number of men suffering from well-marked albuminuria (A, B, C, D grades) in each period	Average per 1,000
3 to 7 months inclusive	1,298	88	68	43	33
8 ,, 12 ,, ,,	1,360	77	57	41	30
13 ,, 17 ,, ,,	1,336	83	62	36	27
18 ,, 22 ,, ,,	1,160	61	53	28	24
23 ,, 27 ,, ,,	1,032	81	78	41	39
28 ,, 32 ,, ,,	890	61	68	33	37
33 ,, 37 ,, and over	2,895	177	61	80	28

TABLE XXXV.—Relation of Length of Service to Presence of Albumin and Casts in Fourth Group of 10,000 Men Examined.

Length of service in months	Total number of men with given period of service	Number with casts		Average with casts per 1,000
		Epithelial	Hyaline	
3	221	—	4	18
4	295	3	2	17
5	199	2	2	20
6	325	—	6	19
7	258	2	1	11
8	217	3	1	19
9	182	3	1	22
10	274	3	5	29
11	253	2	2	16
12	434	3	5	19
13	193	1	2	16
14	314	6	6	38
15	330	2	5	21
16	297	2	5	23
17	202	1	2	15
18	410	2	4	15
19	165	2	2	24
20	199	1	3	20
21	172	1	—	7
22	214	—	1	5
23	107	2	1	28
24	583	9	12	36
25	77	2	1	39
26	109	2	—	18
27	156	3	3	38
28	151	4	—	26
29	91	—	1	11
30	336	5	4	27
31	113	3	2	44
32	199	1	—	5
33	169	2	4	36
34	216	1	4	23
35	160	1	1	12
36	1,303	6	13	14
37 and over	1,047	11	10	20

TABLE XXXVI.—Incidence of Casts in Fourth Group of 10,000 Men for each Successive Period of Five Months' Training.

Period of training	Number of men in each period	Number of men with casts in each period	Average per 1,000
3 to 7 months inclusive ..	1,298	22	17
8 ,, 12 ,, ,, ..	1,360	28	20
13 ,, 17 ,, ,, ..	1,336	32	23
18 ,, 22 ,, ,, ..	1,160	16	14
23 ,, 27 ,, ,, ..	1,032	35	34
28 ,, 32 ,, ,, ..	890	20	22
33 ,, 37 ,, and over ..	2,895	50	19

TABLE XXXVII.—Relation of Length of Service to Total Albuminuria in Fifth Group of 10,000 Men.

Length of service in months	Number of men with albuminuria in given period of service	Total number of men with given period of service	Percentage with albuminuria after given period of service
3	3	68	4·4
4	5	133	3·8
5	4	205	1·9
6	15	217	6·9
7	81	741	11·0
8	29	345	8·4
9	15	157	9·6
10	10	160	6·2
11	20	268	7·5
12	18	450	4·0
13	15	223	6·7
14	17	245	7·0
15	15	215	7·0
16	22	364	6·0
17	15	173	8·1
18	23	343	6·7
19	12	162	7·4
20	12	156	7·7
21	7	139	5·0
22	17	169	10·0
23	7	87	8·0
24	45	575	7·8
25	5	94	5·3
26	11	104	10·5
27	10	154	6·5
28	9	171	5·2
29	2	105	1·9
30	25	381	6·6
31	4	98	4·1
32	10	162	6·1
33	11	206	5·3
34	14	215	6·5
35	4	112	3·5
36	77	1,241	6·2
37 and over	86	1,336	6·4

TABLE XXXVIII.—RELATION OF LENGTH OF SERVICE TO WELL-MARKED ALBUMINURIA (A, B, C, D GRADES) IN FIFTH GROUP OF 10,000 MEN.

Length of service in months	Number of men with well-marked albuminuria (A, B, C, D grades) in given period of service	Total number of men with given period of service	Percentage with well-marked albuminuria (A, B, C, D grades) after given period of service
3	2	68	2·9
4	1	133	0·8
5	2	205	1·0
6	10	217	4·6
7	44	741	5·9
8	17	345	4·9
9	6	157	3·8
10	3	160	1·8
11	9	268	3·3
12	7	450	1·5
13	7	223	3·1
14	10	245	4·1
15	9	215	4·2
16	10	364	2·8
17	10	173	5·8
18	11	343	3·2
19	3	162	1·8
20	4	156	2·6
21	4	139	2·9
22	8	169	4·7
23	5	87	5·7
24	21	575	3·6
25	5	94	5·3
26	4	104	3·9
27	6	154	3·8
28	5	171	2·8
29	1	105	0·9
30	14	381	3·7
31	4	98	4·0
32	5	162	3·0
33	7	206	3·4
34	9	215	4·2
35	2	112	1·8
36	37	1,241	3·0
37 and over	38	1,336	2·8

TABLE XXXIX.—INCIDENCE OF TOTAL ALBUMINURIA AND OF WELL-MARKED ALBUMINURIA (A, B, C, D GRADES) IN FIFTH GROUP OF 10,000 MEN FOR EACH SUCCESSIVE PERIOD OF FIVE MONTHS' TRAINING.

Period of training	Number of men in each period	Total Albuminuria		Well-marked Albuminuria	
		Total number of men suffering from albuminuria of all grades in each period	Average per 1,000	Total number of men suffering from well-marked albuminuria (A, B, C, D grades) in each period	Average per 1,000
3 to 7 months inclusive	1,364	108	79	59	43
8 ,, 12 ,, ,,	1,380	92	66	42	30
13 ,, 17 ,, ,,	1,220	84	69	46	37
18 ,, 22 ,, ,,	969	71	73	30	31
23 ,, 27 ,, ,,	1,014	78	77	41	40
28 ,, 32 ,, ,,	917	50	54	29	32
33 ,, 37 ,, and over	3,110	192	61	93	30

TABLE XL.—Relation of Length of Service to Presence of Albumin and Casts in Fifth Group of 10,000 Men Examined.

Length of service in months	Total number of men with given period of service	Number with Casts: Epithelial	Number with Casts: Hyaline	Average with casts per 1,000
3	68	1	—	14
4	133	—	—	—
5	205	—	2	10
6	217	1	8	41
7	741	6	11	23
8	345	1	6	10
9	157	4	3	44
10	160	11	1	75
11	268	1	6	26
12	450	1	4	11
13	223	1	5	27
14	245	2	6	32
15	215	3	5	37
16	364	6	3	25
17	173	3	4	40
18	343	2	4	17
19	162	3	3	27
20	156	1	2	19
21	139	1	1	14
22	169	2	4	36
23	87	1	—	11
24	575	2	10	21
25	94	—	2	21
26	104	2	3	48
27	154	—	4	26
28	171	—	2	11
29	105	1	—	9
30	381	1	3	10
31	98	1	—	10
32	162	1	2	18
33	206	2	5	34
34	215	—	4	19
35	112	—	1	9
36	1,241	4	19	18
37 and over	1,336	7	17	19

TABLE XLI.—Incidence of Casts in Fifth Group of 10,000 Men for each Successive Period of Five Months' Training.

Period of training	Number of men in each period	Number of men with casts in each period	Average per 1,000
3 to 7 months inclusive ..	1,364	21	16
8 ,, 12 ,, ,, ..	1,380	20	14
13 ,, 17 ,, ,, ..	1,220	23	19
18 ,, 22 ,, ,, ..	969	14	14
23 ,, 27 ,, ,, ..	1,014	19	19
28 ,, 32 ,, ,, ..	917	7	8
33 ,, 37 ,, and over ..	3,110	46	15

(*To be continued.*)

Reviews.

Principles of General Physiology. By William Maddock Bayliss, M.A., D.Sc., F.R.S. Second Edition revised. London: Longmans, Green, and Co. 1918. Pp. xxiv and 858, $9\frac{3}{4} \times 5\frac{1}{2}$. Price 24s. net.

One of the consequences of the present conditions is that books sent for review fall at times into the hands of confident persons whose sole qualification is interest in the subject with which they deal—an interest not supported by any extensive or accurate knowledge of its literature. Some books lend themselves to the more detached consideration of the reviewer indifferently equipped with special knowledge, who has sufficient general knowledge of the greater whole of which the special subject forms a part, to express some opinion concerning the appropriate niche in which the work should be placed.

Professor Bayliss's volume is distinguished from all others of which the present reviewer has any knowledge in that physiology is taken as a branch of general physics, and the treatment of the subject is on those lines familiar to all students of modern work in pure science. One has often wondered how long we were to wait for the treatment in this way of a subject which has usually been dealt with in a manner showing definite evidence of descent from the days in which histology was the important element, through stages in which the facts, but not the great principles, of physical science were stated, often with obviously imperfect understanding. In working over a special subject in that dim era before the War, it was curious to see how underlying general principles were not only neglected but concealed by mode of presentation of the facts. Professor Bayliss's book shows that among investigators a new spirit has arisen which will lead to great developments, not only in methods but in results.

The indifferent qualifications of the reviewer render it impossible for him to venture with the smallest advantage upon any detailed criticism. For the same reason he finds it difficult to place, one is tempted to say categorize, the book. Professor Bayliss postulates a considerable knowledge of various sciences, including pure mathematics, and it is obvious that no reader who has not access to a well-equipped special library can get the full value out of this book. It is not a student's text-book for which one has to offer up thanks; it appears destined more for the investigator, possibly the super-physiologist. It is not systematic, in the sense that one can look up a subject and find all about it on consecutive pages. This is outside its aim. But it is difficult to conceive a more stimulating discussion of the larger questions of physiology viewed as a part of the mosaic of general physics.

It has been found by the reviewer a most fascinating book, not least because the author, like John Ruskin, has delightful asides which are at times only just relevant to the point under discussion. Both prefaces should be read carefully; one comes to the surface with a desire to know more of Claude Bernard. The portraits of famous physiologists add to the interest, and the book is otherwise well illustrated. The paper, no doubt, is bad, owing to the present conditions, which affects the reproduction of the engravings. But the print is legible and only appearance, possibly also permanence, suffers, while the positive advantage of the light weight of the volume more than makes up for these small defects.

R. J. S. S.

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Original Communications.

METHOD OF ESTIMATING ENERGY EXPENDITURE BY INDIRECT CALORIMETRY.

By LIEUTENANT-COLONEL E. P. CATHCART.
Royal Army Medical Corps

THE examination of the energy expenditure of man has been avoided by many, usually on the grounds that the limited means at the disposal of the investigator are inadequate to carry out such a research.

It may be confidently stated that the difficulties of such an investigation are more apparent than real, and further, that the majority of laboratories, if they have not the complete apparatus necessary at their disposal, can obtain the same at a comparatively small outlay. The apparent difficulties of such an investigation have been perhaps accentuated by the accounts, in the modern text-books, of the methods by which the results quoted have been obtained—results of workers like Rubner and Zuntz, and more recently of Atwater, Benedict and Lusk, who have, for the most part, used very complicated and costly installations for the direct measurement of the energy expenditure.

Direct calorimetry undoubtedly gives marvellous results in the hands of competent observers like those referred to, and it is true that such a procedure is absolutely impracticable for general use. Fortunately, however, there exists the method of indirect calorimetry, which depends for its results on the analysis of the expired air.

The most complete study of the various methods of indirect calorimetry has been made by T. M. Carpenter [1], in which he compared the bed respiration calorimeter, the Benedict universal respiration apparatus, the Zuntz-Geppert method, the Tissot method and the Douglas bag method. All types of apparatus have their drawbacks, and all types have their special

advantages. For general everyday use both for laboratory and field experiments, the Douglas bag method undoubtedly possesses unique advantages, as Yandell Henderson [2] has well said, " This apparatus is much simpler and easier to use, more accurate, and affords more nearly normal conditions as regards the air breathed by the subject, than any other respiratory device with which we are acquainted. It is equally adaptable to all conditions—laboratory, bedside, race track or mountain peak."

It is the easiest method to adopt for field work. In a series of experiments on the energy expenditure of recruits in training, which are at present being carried out, this method has been adopted, and has proved eminently satisfactory. The subject does not require to be segregated from his fellows, he performs the ordinary drills of the day, and whilst he is at his ordinary work the sample is taken. The method gives equally good results with the subject at rest.

Theoretical Considerations.

The principal underlying indirect calorimetry is, that by the estimation of the oxygen taken in for the combustion of the foodstuffs and the amount of expired carbon dioxide, arising from this combustion, a direct index of the material consumed can be obtained. By the oxidation to its end products of a given weight of any combustible material, a definite amount of oxygen will be utilized, a definite amount of carbon dioxide will be given off, and a definite amount of energy liberated. As the body is dependent on the combustion of foodstuffs for its supply of energy and as all the energy developed in the body may eventually be computed as heat, the weight or volume of consumed oxygen (or also of carbon dioxide given off) corresponds to the liberation of a definite amount of heat, hence the caloric factor of oxygen or of carbon dioxide. In practice, as the oxygen figures for different classes of foodstuffs approximate more closely than the carbon dioxide figures, they are usually preferred for making the calculations.

In the organism we have to deal not merely with the complete combustion of a single foodstuff, but have to consider the intake of oxygen for the combustion of several materials and experiment has shown that the caloric value of oxygen varies with the nature of the material oxidized. Some indication, therefore, of the type of combustion must be obtained. The clue to the nature of the combustion is gained by the study of the respiratory quotient, provided always that the estimation of the gaseous metabolism has been carried out under strictly normal conditions. As this quotient is the ratio of the output of carbon dioxide over the intake of oxygen, it is evident that factors which disturb or interfere with the exact estimation of either gas, will disturb the ratio, thus simple irregularity of the respiration, as in panting after strenuous exercise, leads to pumping out of excessive amounts of CO_2, and a consequent rise in the respiratory quotient.

It can be shown by calculation that in the combustion of carbohydrate, the volume of CO_2 given off is equal to the volume of O_2 required for combustion; hence the respiratory quotient is unity; experiment has confirmed this theoretical value. In the case of fat which is poor in oxygen, the volume of oxygen consumed is much higher than the CO_2 given off, so that we have the low respiratory quotient of 0·707. The respiratory quotient for protein is generally held to be about 0·80. In practice, however, as the normal consumption of protein is very small, during the strictly limited duration of the experiment, the oxygen consumption due to oxidation of protein is ignored, and the calculations confined to the combustion of carbohydrate and fat. For very accurate work, the protein consumption can be determined from the output of nitrogen in the urine. For every gramme of urinary nitrogen 8·45 grammes of oxygen (1 gramme of oxygen equals 0·699 litre) are required for the oxidation process and 9·35 grammes of carbon dioxide (1 gramme of carbon dioxide equals 0·5087 litre) are given off. Therefore if the appropriate amounts of oxygen and carbon dioxide are deducted from the total intake of oxygen, and from the total output of carbon dioxide, an accurate estimate of the substances oxidized in the organism may be obtained. The following table (Table I) shows the relative combustion of carbohydrate and fat for a given respiratory quotient.

TABLE I.

R.Q.	Carbohydrate	Fat
1·00	100 per cent	0 per cent
0·95	83 ,,	17 ,,
0·90	66 ,,	34 ,,
0·85	49 ,,	51 ,,
0·80	32 ,,	68 ,,
0·75	15 ,,	85 ,,
0·707	0 ,,	100 ,,

Generally speaking, it may be said that for each thousandth part increase of the respiratory quotient above the basal value of 0·707, the caloric factor of oxygen rises about 0·00123. Table II modified by Lusk [3] from Zuntz—Schumburg gives the results in detail.

TABLE II.—CALORIES FOR ONE LITRE OXYGEN.

R.Q.	0	1	2	3	4	5	6	7	8	9
0·70	—	—	—	—	—	—	—	4·686	—	—
0·7	—	4·690	4·702	4·714	4·727	4·739	4·752	4·764	4·776	4·789
0·8	4·801	4·813	4·825	4·838	4·850	4·863	4·875	4·887	4·900	4·912
0·9	4·924	4·936	4·948	4·960	4·973	4·985	4·997	5·010	5·022	5·034
1·0	5·047	—	—	—	—	—	—	—	—	—

In the following pages the procedure of carrying out an experiment will be given in detail. For all special details as regards the minutiæ of gas

analysis, Dr. Haldane's book, "Methods of Air Analysis," [4] should be consulted. It is indispensable for those who purpose carrying out investigations along this line.

Description of Apparatus.

Douglas Bag [5].—The best size of bag for general use is the largest, holding very approximately 100 litres (usually more).

Mouth-piece.—The mouth-piece which has been found most convenient is the modified Denayrouse mouth-piece used on the small box respirator. In order to make certain that the chance of leaking, owing to the man opening his lips, be reduced to a minimum, an additional flange of soft rubber sheeting (see sketch fig. 1) cut so that it will fill up the space between the cheeks and the teeth, is fitted behind the ordinary flange of the mouth-piece. When this soft rubber becomes thoroughly moistened

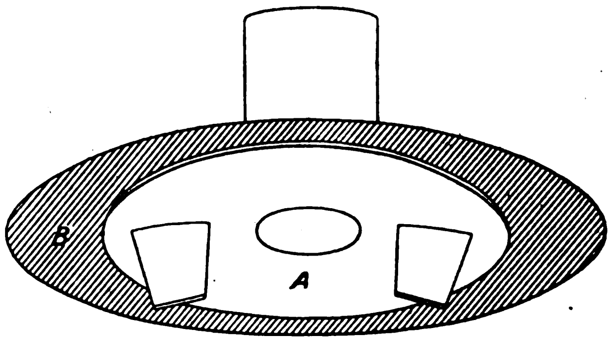

Fig. 1.

with saliva, there is little or no chance of leaking. (During experiments, if there is any doubt about the result, or if very great accuracy is required, the subject should be tested for leaking at the mouth and nose by putting on a lather of soap with a shaving brush. If there is any leak, it is readily detected by the formation of bubbles.)

Valves.—The valves which have been employed by Captain Orr and myself were specially made. We had fitted two of the inlet all-rubber valves of the small box respirator into a small tin container. (These valves were made for us by Major H. S. Raper, of the Anti-Gas Research Department.) Any good type of valve, provided it is double-acting, will prove suitable. The mica valve provided by Messrs. Siebe, Gorman, with the apparatus, however, is not very satisfactory, mainly on account of the fact that there is a sharp click at each breath, and listening for this click, we find, tends to upset the subject's rate of respiration. If he does not hear the click, he unconsciously accelerates his respiration.

Nose Clip.—Messrs. Siebe, Gorman and Co. manufacture an excellent

nose-clip on a ratchet principle, but in practice we have found that a nose-clip similar to that provided in the small box respirator gives excellent results.

METHOD OF CARRYING OUT AN EXPERIMENT.

The subject adjusts the tube carrier to his head (see sketch, fig. 2), passes his arms through the leather straps of the bag, gets the bag adjusted in a comfortable position; the corrugated rubber connexion tubing is then fixed to the aluminium valve of the bag, the mouth-piece fitted into the mouth, the nose-clip adjusted accurately, and then the subject starts the exercise or work to be performed. After the subject has got into the swing of the work, e.g., digging or marching, say after five minutes, the observer

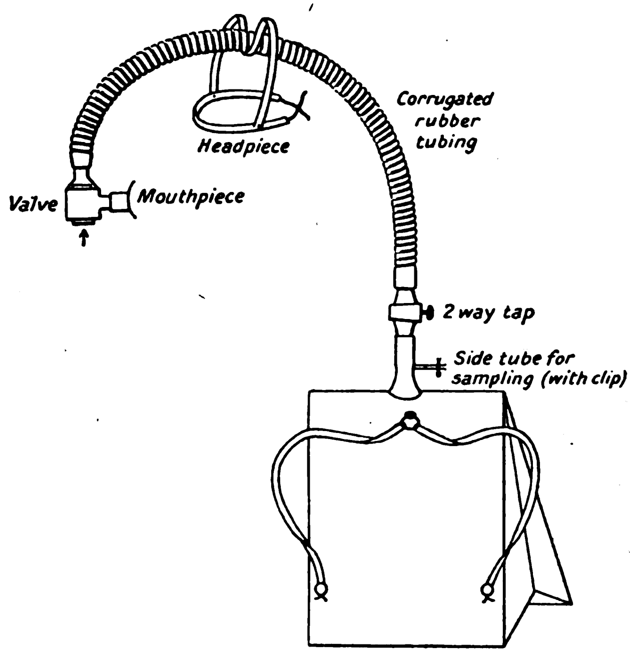

FIG. 2.

turns the aluminium cock so that all the expired air passes directly into the bag, and is thus collected. Note that the side tube for drawing off the air sample is properly clipped. The duration of the collection depends on the strenuousness of the exercise—the more strenuous the work, the greater the amount of air passing through the lungs, and therefore the shorter the duration of the experiment. Care must be exercised to see that the bag does not become too full, so that the subject has to breathe against pressure, a condition which is a fruitful source of error. We have found that 100 to 120 litres, according to the particular bag used, can be

collected without giving rise to any difficulty in breathing. The time of opening and closing the aluminium cock must be most carefully noted.

The expired air having been collected in the bag, it must now be measured and analysed for its content of oxygen and carbon dioxide. In order to measure the total volume, the bag is connected with an experimental gas meter, which reads to two-hundredths of a litre (an excellent meter suitable for the purpose is made by Messrs. Wright, Westminster). *Note that the water level of the metre is flush with the level mark in the meter gauge.* The contents of the bag should have been thoroughly mixed by lightly kneading the bag before measurement takes place. The connexion having been made, the bag is slowly and carefully pressed so that the stream of air through the meter is as steady and constant as possible. Measurement at the rate of eight to ten litres per minute gives in our experience the best result. Great care must be taken towards the end to see that the pressure is uniform, and to see at the same time that the last of the air is expressed. If pressure is irregular, there is always a tendency for the indicator to back-lash, giving in this way a faulty reading. Whilst the air is being measured, a sample is drawn off from the bag by the small side tube provided for the purpose. Before the sampling tube is attached, the air in the side tube must be washed out. To do this, and at the same time to prevent undue loss, it has been found most satisfactory to place the mouth of the side tube just under water in a beaker held in position for the purpose, the clip removed, and a few bubbles of air allowed to escape. Allowance for this escape and the sample collected is, of course, made. The clip replaced near the end of the tube, the sampling tube filled with mercury is connected with the rubber tube, the clip removed, and then by turning the taps of the sampler carefully the mercury is allowed to run out slowly drawing in the sample of air for analysis. As soon as the sampling tube is filled, the taps should be closed, and the rubber side tube again clipped to prevent any further loss of air. The temperature of the water in the meter should be noted by means of the thermometer provided whilst the air is being measured. The measurement of the air and the taking of the sample should be done as soon after the conclusion of the experiment as possible, as the rubber of the collecting bag can take up—slowly it is true—a certain amount of carbon dioxide. As a rule, the loss due to this cause, unless the air has been retained in the bags for hours, is very small. All bags should be tested before use.

Analysis of the Sample of Air.

The sample of expired air having been collected, it must now be analysed, and the apparatus used is the Haldane Apparatus, either laboratory or portable pattern. For exact work it is preferable and more easy to use the laboratory size, but as Higgins and others have definitely shown, the smaller portable type gives excellent results for physiological analyses. (Both types of apparatus are made by Messrs. Siebe, Gorman and Co., Westminster Bridge Road, S.E.)

It is assumed, of course, that previous to carrying out the actual experimental work, the burette has been tested for the accuracy of its graduation, and that the whole apparatus has been tested for tightness.

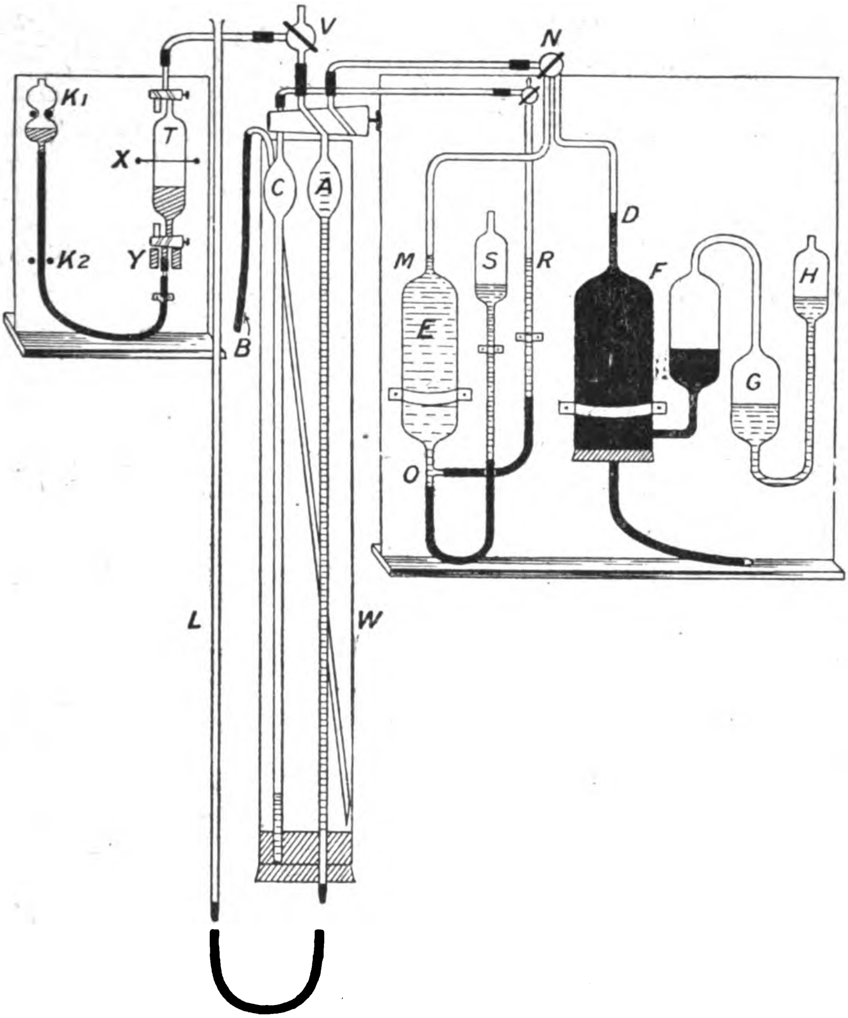

FIG. 3.—A, gas burette; B, tube to blow air through water jacket; C, control tube; D, level mark for pyrogallate; E, potash pipette; F, pyrogallate pipette; G and H, bulbs filled with 10 per cent potash solution; K1 and K2, high and low position of mercury reservoir of sampling tube; L, levelling tube for gas burette; M, level mark for potash pipettes; N, two-way tap connecting gas burette either with the potash or pyrogallate pipettes; O, connexion between potash pipette and control tube (C); R, level mark on control tube connexion; S, potash reservoir; T, sampling tube held in position by (1) tapes tied at X and (2) by small wood support Y; V, three-way tap; W, water jacket for gas burette and control tube.

Details as regards the procedure to be followed in checking the burette and apparatus are most clearly given in Haldane's book.

(Portable apparatus is identical in principle and method of using.) (See sketch, fig. 3.)

Two points must be attended to before drawing a sample of air into the burette: (1) The connecting tubing to the absorption vessels must be free from oxygen, carbon dioxide or any other absorbable gas, otherwise the analysis would be vitiated. In practice these connexions are kept filled with nitrogen, a supply of which will have probably been left from a previous analysis. If there is no residual nitrogen, a rough analysis of air must be performed, the carbon dioxide and oxygen completely absorbed and the nitrogen left to fill the connexions; (2) the pyrogallate and the potash must be brought to the level marks D R and M on the gauges of the absorption pipettes and of the control tube (the tap of the control tube is kept open to the outside air until this adjustment is made and it is then closed).

When the sample of air to be analysed is drawn into the burette, care must be taken to avoid drawing in any of the atmospheric air present in the connexion tubing. Captain Orr has devised a very simple, and at the same time, most effective method of getting a sample of air for analysis from the sampling tube (see fig. 3). At the top of the gas burette (A), connected to it by thick-walled rubber tubing, is a three-way tap (V) which allows connexion to be made either with the outside air or with the sampling tube. To collect the sample, open the three-way tap to outside air only, and by means of the levelling tube (L) force the mercury up through the burette to the three-way tap. The three-way tap is then turned so that it is opened to air and to the sampling tube (T). The air in the sampling tube is under pressure as the mercury reservoir is kept in position (K.1). The tap at the top of the sampling tube is carefully opened, and as a result there is a blow through of air from the sampling tube to the outside air through the three-way tap. In this way all atmospheric air is blown out, and the connecting tube is filled with the air to be analysed. The three-way tap is turned as soon as the connexion is filled, so that the sampling tube and the burette are connected, the levelling tube is lowered and a sample drawn into the burette. Whilst the sample is being drawn in transfer the mercury reservoir connected with the sampling tube to position (K. 2). In order to prevent accidents by having undue positive or negative pressure in the measuring burette, it is well to determine beforehand, once and for all, a level for the mercury in the burette—twenty cubic centimetres is a very convenient figure—and by having a clamp at a suitable height, the levelling tube can be fixed at once, the final adjustment to normal pressure being made by means of the mercury reservoir in connexion with the sampling tube. As soon as the level is reached, the tap on the burette is closed to the sampling tube and opened to the potash pipette (E). When this is done, the level of the potash in the gauges will almost certainly be slightly disturbed, but this can readily be readjusted at R by raising or lowering S and at M by altering the position of the levelling tube. The level of the mercury is now read off in the burette with the aid of a lens.

This reading must be most correctly carried out; with the aid of the

lens it can be done to 0·002 cubic centimetre. The sample is then driven over into the potash pipette (E) by raising the levelling tube, the mercury being passed up the burette to the level of the tap. The sample is then brought back into the burette and the same procedure again repeated. This ought to be done four or five times to make certain that all traces of carbon dioxide have been absorbed. Complete absorption is shown by the fact that no further reduction in volume takes place. The reading is then made and carefully noted. The tap N is turned so that the burette is in connexion with the pyrogallate pipette and the air is passed five or six times into the pyrogallate pipette (F).

As, however, a certain amount of oxygen will have been left in the connexion between the potash and the tap (i.e., between E and N), this is washed out by passing the sample into the potash pipette and back, and then into the pyrogallate pipette and back twice. As a general rule this washing out should be done a third time.

The levels at D R and M are again adjusted and a reading of the burette done. In order to make certain that the last trace of oxygen has been removed it is well to pass the sample once more into the pyrogallate and do another reading. If absorption has been complete, the reading should be identical with the previous reading.

The following is an example of an analysis of expired air :—

TABLE III.

Volume of expired air taken	19·992 c.c.	
After CO_2 absorbed	19·284	
∴ CO_2	0·708	= 3·54 per cent
After O_2 absorbed	15·914	
∴ O_2	3·370	= 16·86 per cent

In connexion with the analysis, certain points must be borne in mind :—

(1) See that the apparatus is tight in all its connexions; see that every tap is properly greased and pushed well home; see that the rubber connexions have not perished.

(2) Burette must be kept absolutely clean. A dirty burette means faulty analysis and waste of time. The oxygen figure with a dirty burette is appreciably higher than with a clean one. A fruitful source of contamination, especially in warm weather or a hot laboratory, is grease from the burette tap.

(3) Remember to keep a supply of water in the control tube and to keep the burette itself moistened with very dilute sulphuric acid. A dry burette is also a common source of error, as the sample when passed into the potash will actually increase in volume by taking up moisture.

(4) Keep a careful watch on your absorbing solutions, the potash and the pyrogallate. The best index for renewal is when the absorption becomes

very slow. Remember to keep a stock of the pyrogallate made up; matured pyrogallate is a much more efficient absorber of oxygen than a freshly prepared solution. Strength of solutions used: (1) potassium hydrate ten per cent.; (2) ten per cent. pyrogallic acid in KOH solution of specific gravity 1·55.

(5) If red rubber has been used with the potash pipette, see that the potash is not unduly yellow from the formation of potassium sulphide from sulphur in the rubber. Potassium sulphide may absorb an appreciable amount of oxygen.

(6) If by accident any of the potash or pyrogallate is sucked over, the taps are certain to stick unless they are carefully cleaned. The burette also must be carefully and thoroughly cleaned with dilute sulphuric acid.

(7) Even with most careful treatment the burette gradually becomes dirty, and as already stated in (2) a dirty burette means faulty analysis. The best check on the burette is to do frequent analysis of the outside air —this should be done as a matter of routine, even when a large number of daily analyses are being carried out, every thirty to fifty analyses, and of course where the apparatus is being used intermittently, it should be done each time before a series of analyses is done. The Haldane average value for outside air of 20·93 per cent oxygen and 0·03 per cent carbon dioxide should be used as the standard. In the event of an error being detected the analysis should be noted, and the figure obtained used as a correction factor, or preferably, if time permits, the burette should be thoroughly cleaned. In any case it should be cleaned at the earliest possible moment. If everything is correct, the error of reading and adjusting the pressure combined ought not to exceed 0·001 cubic centimetre, equalling 0·005 per cent of the volume read off.

(8) At the end of an analysis the nitrogen left over should be kept for further use, for washing out the connexions. It can very conveniently be kept stored in the pyrogallate pipette.

(9) At the close of an analysis, the taps should be so turned as to disconnect the burette from the absorption pipettes and open the control tube to the air. If this is not done, accidents due to sucking over of the absorbing solutions from a fall of temperature or a rise in the barometric pressure are likely to occur.

(10) The two criteria for successful work in gas analysis are accuracy and cleanliness.

Working up of Analytical Data.

As already noticed at the conclusion of the experiment, during the measurement of the air in the Douglas bag, the temperature of the water in the gas meter was taken. It is now necessary to calculate the volume of the carbon dioxide given off, and the volume of oxygen absorbed at 0° C. and 760 millimetres pressure. As the volume has been measured moist, it is necessary to ascertain its volume when measured dry. In

TABLE IV.—TABLE FOR REDUCTION TO DRY AIR AT 0° C. AND 760 MILLIMETRES OF 100 VOLUMES OF AIR SATURATED WITH MOISTURE AT DIFFERENT TEMPERATURES AND PRESSURES.

TEMPERATURE		BAROMETRIC PRESSURE IN INCHES OR MILLIMETRES																				
F.	C.	29·13 740	29·21 742	29·29 744	29·37 746	29·45 748	29·53 750	29·60 752	29·68 754	29·76 756	29·84 758	29·92 760	30·00 762	30·08 764	30·16 766	30·24 768	30·31 770	30·39 772	39·47 774	30·55 776	30·63 778	30·71 780
50·0	10·0	92·77	93·02	93·27	93.53	93·78	94·04	94·29	94·54	94·80	95·05	95·30	95·55	95·80	96·06	96·31	96·57	96·82	97·07	97·33	97·58	97·84
50·9	10·5	92·57	92·82	93·07	93·33	93·58	93·84	94·09	94·34	94·60	94·85	95·10	95·35	95·60	95·86	96·11	96·37	96·64	96·86	97·12	97·37	97·63
51·8	11·0	92·36	92·61	92·86	93·12	93·37	93·63	93·88	94·13	94·39	94·64	94·89	95·14	95·39	95·65	95·90	96·16	96·41	96·66	96·92	97·17	97·42
52·7	11·5	92·16	92·40	92·65	92·91	93·16	93·41	93·66	93·91	94·17	94·42	94·67	94·92	95·17	95·43	95·68	95·93	96·18	96·43	96·69	96·94	97·19
53·6	12·0	91·95	92·20	92·44	92·69	92·93	93·18	93·43	93·68	93·94	94·19	94·44	94·69	94·94	95·20	95·45	95·70	95·95	96·20	96·46	96·71	96·96
54·5	12·5	91·75	92·00	92·24	92·50	92·74	92·99	93·24	93·49	93·75	94·00	94·25	94·50	94·75	95·01	95·26	95·51	95·76	96·01	96·27	96·52	96·77
55·4	13·0	91·54	91·79	92·04	92·30	92·55	92·80	93·05	93·30	93·55	93·80	94·05	94·30	94·55	94·81	95·06	95·31	95·56	95·81	96·07	96·32	96·57
56·3	13·5	91·34	91·59	91·84	92·10	92·34	92·59	92·84	93·09	93·33	93·58	93·84	94·09	94·34	94·59	94·84	95·10	95·35	95·60	95·85	96·10	96·35
57·2	14·0	91·13	91·38	91·63	91·88	92·13	92·38	92·63	92·88	93·12	93·37	93·62	93·87	94·12	94·38	94·63	94·88	95·13	95·38	95·63	95·88	96·13
58·1	14·5	90·92	91·17	91·42	91·67	91·92	92·17	92·42	92·67	92·92	93·17	93·42	93·67	93·92	94·16	94·41	94·66	94·91	95·16	95·42	95·67	95·92
59·0	15·0	90·71	90·96	91·21	91·46	91·71	91·96	92·21	92·46	92·70	92·95	93·20	93·45	93·70	93·94	94·19	94·44	94·69	94·94	95·20	95·45	95·70
59·9	15·5	90·50	90·75	91·00	91·25	91·50	91·75	92·00	92·25	92·49	92·74	92·99	93·24	93·49	93·71	93·97	94·23	94·48	94·73	94·98	95·23	95·48
60·8	16·0	90·29	90·54	90·79	91·04	91·29	91·54	91·79	92·04	92·28	92·53	92·78	93·03	93·27	93·52	93·76	94·01	94·26	94·51	94·76	95·01	95·26
61·7	16·5	90·08	90·33	90·58	90·82	91·08	91·33	91·58	91·83	92·07	92·32	92·57	92·82	93·06	93·31	93·55	93·80	94·05	94·30	94·55	94·80	95·05
62·6	17·0	89·87	90·12	90·37	90·61	90·86	91·11	91·36	91·61	91·85	92·10	92·35	92·60	92·84	93·09	93·33	93·58	93·83	94·08	94·33	94·58	94·83
63·5	17·5	89·66	89·91	90·15	90·40	90·65	90·90	91·15	91·40	91·63	91·88	92·14	92·39	92·63	92·88	93·12	93·37	93·62	93·87	94·14	94·39	94·61
64·4	18·0	89·45	89·70	89·94	90·19	90·43	90·68	90·93	91·18	91·42	91·67	91·92	92·17	92·41	92·66	92·90	93·15	93·40	93·65	93·89	94·14	94·39
65·3	18·5	89·24	89·49	89·73	89·98	90·22	90·47	90·72	90·96	91·21	91·45	91·17	91·95	92·19	92·45	92·69	92·93	93·18	93·42	93·64	93·88	94·17
66·2	19·0	89·02	89·27	89·51	89·76	90·00	90·25	90·50	90·74	90·99	91·23	91·48	91·73	91·97	92·22	92·46	92·71	92·96	93·20	93·45	93·69	93·94
67·1	19·5	88·81	89·05	89·30	89·54	89·79	90·03	90·28	90·52	90·78	91·02	91·26	91·50	91·75	91·99	92·24	92·49	92·74	92·99	93·22	93·47	93·72
68·0	20·0	88·59	88·83	89·08	89·32	89·57	89·81	90·05	90·30	90·55	90·79	91·04	91·28	91·53	91·77	92·02	92·26	92·51	92·76	93·00	93·25	93·50
68·9	20·5	88·39	88·63	88·88	89·11	89·36	89·61	89·85	90·10	90·33	90·58	90·83	91·07	91·32	91·56	91·81	92·05	92·30	92·54	92·80	93·05	93·29
69·8	21·0	88·18	88·42	88·67	88·91	89·16	89·40	89·64	89·89	90·13	90·38	90·62	90·86	91·11	91·35	91·60	91·84	92·09	92·33	92·58	92·83	93·07
70·7	21·5	87·95	88·19	88·43	88·67	88·91	89·15	89·40	89·65	89·88	90·13	90·38	90·62	90·87	91·11	91·36	91·60	91·85	92·10	92·34	92·59	92·84
71·6	22·0	87·71	87·95	88·19	88·42	88·66	88·90	89·15	89·40	89·64	89·89	90·14	90·38	90·63	90·87	91·12	91·36	91·61	91·86	92·10	92·35	92·60
72·5	22·5	87·49	87·73	87·97	88·21	88·45	88·69	88·93	89·18	89·42	89·67	89·92	90·16	90·40	90·65	90·89	91·13	91·38	91·63	91·87	92·11	92·37
73·4	23·0	87·26	87·50	87·74	87·99	88·23	88·47	88·71	88·96	89·20	89·45	89·69	89·93	90·17	90·42	90·66	90·90	91·15	91·39	91·64	91·88	92·13
74·3	23·5	87·04	87·28	87·52	87·76	88·00	88·24	88·48	88·73	88·97	89·22	89·46	89·70	89·94	90·19	90·43	90·67	90·91	91·16	91·41	91·65	91·89
75·2	24·0	86·81	87·05	87·29	87·53	87·77	88·01	88·25	88·50	88·74	88·99	89·23	89·47	89·71	89·96	90·20	90·44	90·68	90·92	91·17	91·41	91·65
76·1	24·5	86·58	86·82	87·07	87·31	87·55	87·79	88·03	88·28	88·52	88·77	89·01	89·25	89·49	89·73	89·97	90·21	90·45	90·69	90·93	91·17	91·41
77·0	25·0	86·35	86·59	86·84	87·08	87·33	87·57	87·81	88·06	88·30	88·55	88·79	89·03	89·27	89·50	89·74	89·98	90·22	90·46	90·69	90·93	91·17

order to reduce calculation as far as possible, the table on p. 349, much expanded from Haldane's book, will be of very considerable assistance.

To take an actual experiment recently carried out in connexion with the investigation of training, see Table III, Experiment No. 326. The volume of air expired in ten minutes was 99·75 litres, the temperature of the gas meter 62·2° F. and the barometric pressure 29·53 inches. From Table IV the factor for correction is manifestly about 91·2 and the reduced volume is thus $99{\cdot}75 \times 0{\cdot}912 = 90{\cdot}96$ litres. It may be assumed that the atmosphere breathed during the experiment was pure, that is, it contained 20·93 per cent oxygen and 0·03 per cent carbon dioxide and by difference 79·04 per cent nitrogen. Analysis (see Table III) has shown that the sample of expired air examined contained 16·86 per cent oxygen, 3·54 per cent carbon dioxide and by difference 79·60 per cent nitrogen. From this data it is easy to calculate the volumes of oxygen required and carbon dioxide given off, and the respiratory quotient.

The volume of carbon dioxide (at 0° and 760 millimetres dry) exhaled is first calculated as follows:—

$$\frac{3{\cdot}54 - 0{\cdot}03}{100} \times 90{\cdot}96 \text{ litres} = 3{\cdot}192 \text{ litres.}$$

The calculation of the "apparent" respiratory quotient is next carried out as follows:—

$$\frac{3{\cdot}54 - 0{\cdot}03}{20{\cdot}93 - 16{\cdot}86} = 0{\cdot}862.$$

But this figure is not that of the true respiratory quotient, because during respiration a greater volume of oxygen is consumed than carbon dioxide given off, and as nitrogen is neither given off nor taken up in respiration, "it is evident that for every 100 volumes of expired air, there corresponded in the inspired air, not 20·93 volumes of oxygen" (Haldane), but $20{\cdot}93 \times \frac{79{\cdot}60}{79{\cdot}04} = 21{\cdot}08$ volumes, and therefore to get the true respiratory quotient 16·86 must be subtracted from 21·08.

In order to save this cumbrous calculation, Haldane has devised a simple table of reference (given in a modified form as Table V) from which the "apparent" respiratory quotient being known, the true can be read off. In our example the apparent respiratory quotient is 0·86, hence the true respiratory quotient is 0·83.

TABLE V.—Table for Calculating True from Apparent Respiratory Quotient.

Apparent R.Q.	0	1	2	3	4	5	6	7	8	9
0·7	0·649	0·660	0·671	0·682	0·693	0·704	0·715	0·726	0·738	0·749
0·8	0·760	0·771	0·783	0·794	0·806	0·817	0·829	0·841	0·853	0·865
0·9	0·877	0·889	0·901	0·913	0·925	0·937	0·950	0·962	0·975	0·987
1·0	1·00	—	—	—	—	—	—	—	—	—

The volume of carbon dioxide given off and the true respiratory quotient being known, the volume of oxygen absorbed is readily calculated by dividing the carbon dioxide output by this true respiratory quotient. In the present example, that is, 3·192 ÷ 0·83 = 3·840 litres oxygen. As the result is usually recorded in volume of oxygen per minute, the total volume of oxygen is divided by the duration of the time of the experiment, in this instance ten minutes, hence the oxygen consumption was at the rate of 384 cubic centimetres per minute. In order to convert this figure into energy expenditure, it is multiplied by the factor given in Table II for the respiratory quotient obtained, thus 384 × 4·838 = 1·86 calories per minute. As it is obvious this figure is only of value in relation to the subject on whom the experiment was carried, some universal basis of calculation must be

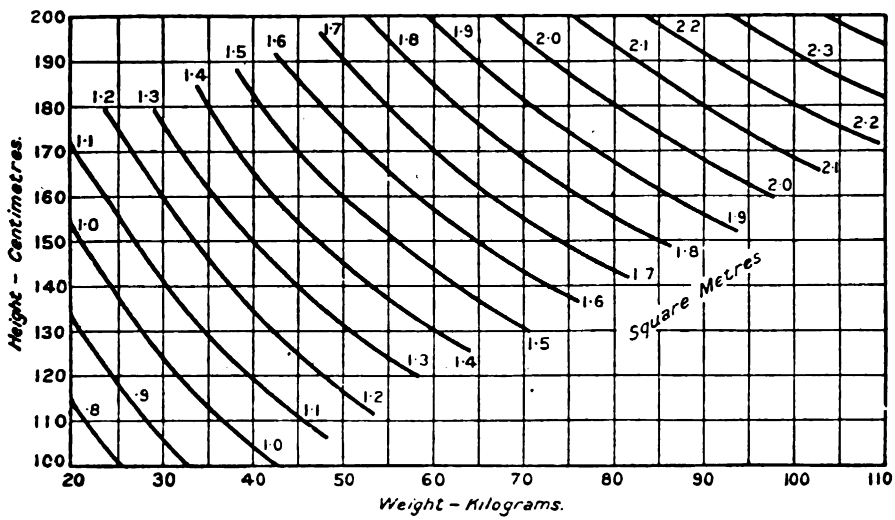

FIG. 4.

adopted. Very frequently the basis used is calorie expenditure per kilogram body weight, but this is not a secure basis, as body weight may either be due to a mass of active tissue, like muscle, or a mass of inactive material, like fat. As the level of metabolism is a function of the mass of active tissue, it has been found that a much more secure basis for calculation can be obtained, if the surface area of the body (i.e., height plus weight) is used. The modern formula used for this calculation is the result of the careful work of D. and E. F. Du Bois, [6] in New York, who have devised the following chart from which the estimation of the surface area in square metres for various heights in centimetres and weights in kilograms can be made at a glance (fig. 4).

The subject of the experiment already detailed had a height of 163 centimetres, and weighed 50 kilograms. His surface area accordingly

was approximately 1·52 square metres, and hence his energy output converted into a standard basis of calories per square metre amounted to 1·22 calories per minute, or 73·2 calories per hour.

Statement of Results.

The question as to the number of places the figures in data of metabolism experiments should be expressed has recently been dealt with by Lusk and his collaborators [7]. Generally speaking, the number of digits published should just be sufficient to do justice to the experiment, and at the same time allow other workers to recalculate the work. Every effort should be made to keep *all* possible errors within the limits of one per cent, as Lusk says: "In metabolism work, the analytical error is seldom much less than one per cent. A variation of one per cent in the result of an experiment would not change its significance or effect its interpretation. For these reasons, it seems unnecessary to publish more than three significant figures in the tables of data, and in some cases it is not worth while to publish more than two. In order to avoid the accumulated rejection error, it is advisable to retain four figures wherever possible in the calculations and reject the fourth digit only in the final result."

In rejecting figures, the rule is to increase by one the last figure retained when the first left hand rejected figure is 5 or greater; otherwise leave it unchanged. Thus 5·437 would become 5·44, but 5·434 would remain as 5·43.

In stating the respiratory quotient give only two figures; third figure, except in certain pathological conditions, is without significance.

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AN ATTEMPT AT CLASSIFICATION OF *BACILLUS DYSENTERIÆ*, BASED UPON AN EXAMINATION OF THE AGGLUTINATING PROPERTIES OF FIFTY-THREE STRAINS.

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(*Continued from p.* 271.)

PART II.

Technique.

(*a*) *Preparation of the Suspensions of Bacilli.*

The medium employed was the agar in ordinary use in the laboratory. The basis of this is trypsinized bullock's heart broth, made as described by Douglas, to which is added three per cent of agar. The reaction is faintly alkaline to litmus.

Each strain to be tested was plated out on this medium and a single colony subcultured on to an agar slope, incubated for eighteen hours, after which the wool plug was waxed. This culture from a single colony was kept as the source of all subcultures for making emulsions of the strain to be tested.

As dysentery bacilli will live for several months under these conditions, subculturing of the strain is reduced to a minimum and the experiments made with the same strain, separated by varying lapses of time, are thus rendered more comparable.

The emulsions were made by washing off an eighteen to twenty-four hour agar culture with 0·8 per cent saline. The latter was freshly prepared each morning for that day's use.

(*b*) *Standardization of Emulsions.*

The emulsions were standardized to $2{,}000 \times 10^6$ per cubic centimetre by the method described by Brown. Dilutions of a one per cent suspension of $BaSO_4$ in one per cent sodium citrate, in glass tubes of standard internal bore, are used as the standard of comparison. The method is simple and saves a great deal of time when many emulsions have to be standardized. I am indebted to Major H. C. Brown, I.M.S., for giving me the set of tubes used in these investigations.

It is important to note in connexion with experiments to be described later that an emulsion of $2{,}000 \times 10^6$ per cubic centimetre by Brown's method works out to be about $3{,}000 \times 10^6$ per cubic centimetre by direct counting in a 0·02 counting cell with dark-ground illuminations.

Living emulsions were used throughout these investigations.

(c) *The Preparation of Agglutinating Serum.*

Rabbits of from 1,500 to 2,000 grammes were used. These rabbits were known to be "normal" as they were of our own breeding. Rabbits were used as the majority of authors agree that their serum is most specific.

Tulloch, referring to agglutinins, says: "While serum cannot be standardized satisfactorily, as its activity can only be estimated in terms of purely arbitrary units, I think it is advisable to employ only the serum of animals whose course of immunization has been of short duration" (p. 135). In another place, when discussing the "multiplicity of agglutinin-producing antigens," he states that the animal responds more readily to the more specific antigen than to the group antigen. It has also been his experience that an animal responds more readily to the pathogenic than to the less pathogenic constituent of a mixture.

Nicolle states that the evolution of the "minor" is always less regular than that of the "major" agglutinins in all antimicrobic sera except in the case of dysentery.

My own experience is in agreement with the principles thus laid down with the exception of the last clause of Nicolle's statement.

For the above reasons it was my ambition to produce a serum of sufficiently high titre within a period of ten days, using only a minimum number of inoculations. The following method proved satisfactory:—

(1) All inoculations were made intravenously.

(2) Emulsions were killed with 0·5 per cent phenol.

(3) The second dose was given five days after the first dose.

(4) The animal was bled on the tenth day from the date of the first dose.

Two scales of dosage were used:—

(1) First dose 500×10^6, second dose $1{,}000 \times 10^6$, giving a titre of 1 in 4,000 (complete agglutination + + +) on the tenth day.

(2) First dose $1{,}000 \times 10^6$, second dose $2{,}000 \times 10^6$, giving a titre of 1 in 8,000 (complete agglutination + + +) on the tenth day.

Scale 2 was only used with the mannite fermenters, but even with them the mortality was high, and most sera were produced by Scale 1. Each rabbit was immunized against a single strain only. There were remarkably few occasions on which the anticipated titre was not obtained.

(d) *Method of Performing the Agglutination Test.*

The macroscopic method was used in tubes $3 \times \frac{1}{2}$ inches. Into each tube was placed 0·5 cubic centimetre of a dilution of serum and 0·5 cubic centimetre of emulsion, the admixture giving the required final dilution.

According to Lancelin and Rideau, the macroscopic method gives a higher titre than the microscopic method, but they are of opinion that the

physical phenomena of sedimentation may falsify the result as there is some settling down and slight clearing of the upper parts of the control tubes in twenty-four hours, and only careful study of the sediment shows it not to be due to agglutination.

This has not been my experience with the strength of emulsion used, though I have noticed some slight sedimentation with stronger emulsions. With living emulsions of $2{,}000 \times 10^6$ per cubic centimetre (Brown), whenever there has been sedimentation it has been due to agglutination, as moderate shaking has thrown up the sediment in definite clumps which only break up into smaller clumps with severe shaking.

(e) The Time required for the Completion of the Agglutination Test.

Lancelin and Rideau recommend the tubes to be left for twenty-four hours by the macroscopic method when employed for dysentery bacilli. They emphasize the importance of the time factor in dysentery agglutination, since the optimum time is much longer than in typhoid and paratyphoid agglutination. In a table showing the results of examining 15 sera (7 agglutinating "Shiga" and 8 "Flexner") by the microscopic method, they demonstrate an increase in the reaction up to one hour at 37° C., after which time the precision of the reaction is not increased.

Ohno used the macroscopic method in tubes, the volume of suspension and serum being made up to two cubic centimetres, with twenty-four hours as the limit of the test.

Andrewes employed the macroscopic method with broth cultures and read his results after four or five hours at 55° C.

My own experience of the macroscopic method for dysentery bacilli is that the degree of agglutination increases up to twenty-four hours, after which time there is no further increase in the precision of the test. In some cases there is a difference between the readings at eighteen hours and those at twenty-four hours at 55° C. The latter period was therefore chosen as the time limit of the test.

In all the agglutination and absorption tests the reaction of the menstruum in which the organism is suspended is neutral and the electrolyte, NaCl, is constant in its concentration, as all dilutions of serum and emulsions are made with 0·8 per cent NaCl.

(f) The Temperature Factor in the Agglutination Test.

The test was performed in all cases at 55° C. in an incubator containing a dish of water to prevent excessive evaporation from the tubes through the wool plugs. The choice of this temperature was determined by a conversation with Captain W. J. Tulloch, who has since discussed the subject in his paper on the agglutination and agglutinin-absorption reactions. He observed that the convection currents in the tubes are more active at 55° C. than at 37° C., and this he thinks produces the same effect as gentle shaking which

is known to hasten the process of flocculation. He further quotes Gengou's experiments on the flocculation of a $BaSO_4$ suspension when mixed with heated serum, and the stabilization of the suspension when mixed with unheated serum. From this he is led to expect that certain complexes might be demonstrable, for example, at 55° C., which would be unobserved at 37° C., especially as the process of sensitization is akin to denaturation of proteins.

Nicolle has recently devised a rapid method of determining the serological type of meningococcus by agglutination in which he makes use of gentle shaking to accelerate flocculation.

By controlled experiment it was also shown that dysentery bacilli fail to grow at 55° C.

(*g*) *Method of expressing the Degree of Agglutination.*

The following symbols were used in recording the readings:—

+++ = Complete sedimentation with perfectly clear supernatant fluid.

++ = Almost complete sedimentation with small flocculi in the supernatant fluid.

+ = Flocculi visible to the naked eye, suspended in an emulsion otherwise unchanged to the naked eye.

— = No agglutination.

"Fine" agglutination, visible only with the lens, was noted as (+), but is counted as negative for practical purposes.

Friędmann and Steinbock and also Duenna and Lauber lay great stress on the non-specificity of "fine" agglutination.

In reading the results after the first examination of the supernatant fluid, the tubes were shaken to observe the character of the sediment. It was observed that in cases where there was agglutination only visible by the aid of a lens, the characteristic "smoky" appearance of a dysentery emulsion was noticeably altered.

	Unabsorbed serum				Absorbed serum							
Emulsions added	v. Strain to be tested				v. Homologous strain A				v. Strain to be tested			
Dilutions of serum	1 : 1000	1 : 2000	1 : 3000	1 : 4000	1 : 1000	1 : 2000	1 : 3000	1 : 4000	1 : 1000	1 : 2000	1 : 3000	1 : 4000
Strain A (Homologous)	+++	+++	+++	+++	—	—	—	—	..	..	..	..
Strain B ..	+++	+++	++	+	+++	—	—	—	—	—	—	—
Strain C ..	—	—	—	—	+++	+++	+++	+++	—	—	—	—

In submitting the evidence yielded by the absorption test, it is important, if clear interpretation is to be obtained, that the means employed in correlating the results derived from the various experiments with sera of different titre should be clearly defined. The degree of agglutination of the different

strains and the amount of agglutinin absorbed by them from a given serum are compared by an arbitrary method of expressing the results in the form of percentages.

These percentages are obtained by "*counting the pluses*," the agglutination of the homologous strain representing a 100 per cent result. The preceding example will make this method clear.

The serum used in this case is that prepared against strain "A," and its titre is 1 in 4,000, i.e., complete agglutination at that figure (+ + +). With its own strain against the unabsorbed serum it will be found to total twelve pluses, i.e., 100 per cent of agglutination; after the absorption of the serum by this strain, however, there being no agglutinins left, it follows that a 100 per cent of agglutinins have been "absorbed." Strain "B" against the unabsorbed serum A shows nine pluses, or three-quarters of the number shown by the homologous strain "A," therefore strain "B" agglutinates to 75 per cent. After absorption by strain "B" the serum possesses sufficient agglutinins to enable strain "A" to record three pluses, signifying that nine pluses or 75 per cent of agglutinins have been "absorbed" by "B." In the same way strain "C" fails to agglutinate or "absorb" any agglutinins from the serum. It will be noted that strain "B" is found to have completely absorbed the agglutinins from the serum when tested against itself.

Though this method has no pretensions to strict accuracy it will be found to give constant results in the hands of an individual observer accustomed to note his results according to some uniform method, and who uses dilutions capable of being compared.

In order that the results with different sera might be comparable in spite of their differing titres, it was necessary that the dilutions should be standardized. This was done by maintaining a constant relationship between the titre of the serum and the dilutions employed. In this way a dilution of 1 in 1,000 of a serum with a titre of 1 in 4,000 would be expressed as a dilution of TITRE × 4, thus making it comparable with a dilution of say 1 in 2,000 of a serum the titre of which is 1 in 8,000. Thus, whenever percentages are compared the pluses are counted by starting at some constant dilution of serum as expressed in relation to the titre of the serum, such as T. × 8, or T. × 4, etc.

It is obvious that it is impossible to compare a dilution of, say, 1 in 500 of a serum of a titre of 1 in 4,000 with the same dilution of a serum with a titre of 1 in 8,000. But as the end-point of agglutination of a given serum remains constant for a sufficiently long time, and as it is controlled by the homologous strain, it is possible to express dilutions in relation to titre, and this method has the advantage of giving comparable results irrespective of the difference of titre of the various sera used. Furthermore, in the experiments to be compared the spacing of the dilutions must bear a constant relationship to the titre of the serum under examination.

(*h*) *The Method employed in Applying the "Absorption" Reaction. and the Evidence supporting it.*

In devising this technique it was necessary, in order to balance the delicate factors involved in the reaction, to be able to answer the following questions:—

(1) Are living or killed bacilli best for agglutination and "absorption" of agglutinin reactions?

(2) What time is required for complete "absorption" to take place?

(3) At what temperature is "absorption" best carried out?

(4) In what dilution of the serum are agglutinins best "absorbed?"

(5) What is the best density of emulsion to be used?

(6) Is it better to add the required number of bacilli in fractions or all at once? If the former, at what intervals of time should the fractions be added?

The experiments designed to answer these questions were all carried out with the strain which produced the serum, and the results obtained apply only to dysentery bacilli.

(1) Using the standard strength of emulsion (2,000 $\times$ 10^6 per cubic centimetre (Brown)), which was known to absorb completely the agglutinins from the homologous serum in ten hours, living emulsions were found, generally speaking, to agglutinate better than killed emulsions. No marked difference between living emulsions and those heated at a temperature of 65° C. for half an hour was as a rule observed, though an emulsion heated at 80° C. for half an hour was much less agglutinable than the control living emulsion.

In view of the fact that the decrease of agglutinability of emulsions on heating to the same temperature varied in different experiments by from 40 to 100 per cent; remembering also the work of Pauli as to the bearing of concentration of electrolytes on the coagulation of proteins; and considering the resemblance between the behaviour of the antibody-antigen complex and that of denaturated proteins; taking all these things into consideration, it was felt that all idea of using emulsions killed by heat must be abandoned owing to the difficulty of controlling the factors concerned.

This step was taken in spite of it having been shown by Michaelis, Eisenberg aud Volk, Tulloch and others, that it is flocculation and not the union of antibody and antigen which is inhibited by heat; and also Scheller's[1] observation that heated bacteria may absorb agglutinins from sera with more avidity than the same bacteria unheated.

Emulsions killed by suspending them in 0·5 per cent phenol in saline agglutinated quite as well as control living bacteria, but in some cases their power of absorbing agglutinins from serum was slightly reduced and they showed some tendency to sediment in the control tubes as compared with

[1] Quoted by Tulloch; this reference could not be found.

living emulsions. For these reasons freshly made living emulsions were used throughout.

(2) and (3). It was found that 1 cubic centimetre of an emulsion of the density described above completely absorbed the agglutinin from 1 cubic centimetre of a 1 in 100 dilution of a serum (titre 1 in 1,600) in one hour at 37° C., the whole amount of emulsion being added at one time. In other words, about $3{,}000 \times 10^{6}$ bacilli (counted) completely removed the agglutinins from 0·01 cubic centimetre of serum in one hour at 37° C. in a dilution of T. × 16. For all practical purposes this was quite sufficient. As a matter of fact two and a half hours at 37° C. was adopted as the standard in order to allow a wide margin for any lag that might occur with any strain and yet keep the time down to such a limit as would not permit of much growth even in so unfavourable a medium as specific serum.

(4), (5) and (6). These questions are so closely inter-related that they are best considered together, and to meet them experiments were carried out as follows :—

Experiment I.—0·1 cubic centimetre of "Logan" serum (titre 1 in 4,000) was placed in each of nine centrifuge tubes. To each was then added emulsion of "Logan" strain (washed off from twenty-hour agar slopes and counted in a 0·02 counting cell by dark-ground illumination) in such quantity that the sequence of tubes 1 to 9 received respectively 100 million, 500 million, 1,000 million, 1,500 million, 2,000 million, 4,000 million, 6,000 million, 8,000 million and 10,000 million bacilli. The total volume of fluid in each tube was then made up to 1 cubic centimetre, thus giving a dilution of serum of 1 in 10 (equalling T. × 400).

The tubes were incubated for two and a half hours at 37° C., after which the bacilli were thrown down by centrifuging at high speed, and the clear supernatant solution of absorbed serum in each tube titrated in the dilutions of T. × 8, T. × 4, T. × 2, T. × 1·3 and T. × 1, against an emulsion of "Logan" containing $3{,}000 \times 10^{6}$ bacilli per cubic centimetre (counted); unabsorbed "Logan" serum was used as a control.

The result of the experiment was as follows: In tubes 1, 2 and 3 there was no appreciable absorption of agglutinin; in tube 4 absorption occurred to the extent of 15 per cent; in tube 5, 46 per cent; in tubes 6 and 7 60 per cent; in tube 8, 87 per cent; and in tube 9, 92 per cent. These figures are expressed in the form of a graph in curve A of fig. 1.

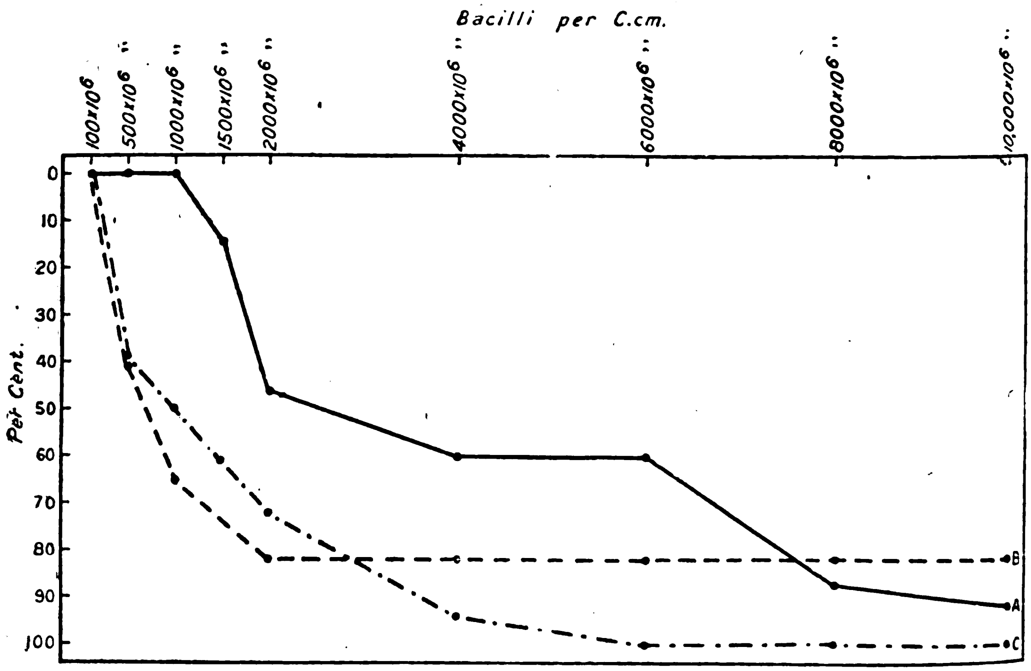
Experiment II.—This is a repetition of the first in all respects, except that the amount of serum placed in each of the nine centrifuge tubes was 0·01 cubic centimetre, so that when the volume of fluid in each tube was made up to 1 cubic centimetre the dilution was 1 in 100 (equalling T. × 40). The object of this experiment was to test the effect of using more dilute serum.

The various steps having been followed as in the first experiment, the clear, absorbed serum was titrated with the following results: In tube 1 there was no appreciable diminution of agglutinin; in tube 2, 41 per cent of

agglutinin was absorbed; in tube 3, 65 per cent; in tubes 4, 5, 6, 7, 8 and 9, 82 per cent. These figures are expressed in curve B of fig. 1.

Experiment III.—This sought to determine the interval of time which should be allowed to elapse between the addition of the four fractions by which the required number of bacilli were to be added in Experiment IV (below). It was found that with intervals of ten minutes no appreciable difference existed between the fractional and all-at-one-time methods, but if the same fractions were added at intervals of twenty minutes there was, all other conditions being equal, a marked difference.

Fig. 1.



Showing the percentage of agglutinin absorbed by varying numbers of homologous bacilli from A, 0·1 c.c. serum ———; B, 0·01 c.c. serum - - - -; C, 0·1 c.c. serum bacilli added in fractions.

Experiment IV.—This was again an exact repetition of the first experiment, except that the required concentration of bacilli was added by four equal fractions at intervals of three-quarters of an hour. After centrifugalization, the clear supernatant fluid in each tube was titrated and gave the following interesting results: In tube 1 there was no appreciable difference; in the remainder of the tubes the diminution of agglutinin was as follows: In tube 2, 39 per cent, in tube 3, 50 per cent; in tube 4, 61 per cent; in tube 5, 72 per cent; in tube 6, 94 per cent; and in tubes 7, 8 and 9, 100 per cent. These figures are expressed in curve C of fig. 1.

In examining these curves it will be seen that in all three experiments

the amount of agglutinin absorbed increases much more slowly than does the concentration of bacteria. This fact proves the "absorption" reaction to be due to the phenomenon of adsorption and confirms the work of Eisenberg and Volk. This is further corroborated by a comparison between curves A and B, fig. 1, where it is seen that the removal of the agglutinins is more complete, in relation to the various concentrations of bacteria, in the more dilute solution of serum (curve B).

By comparing curves B and C, fig. 1, it will be noticed that the effect of adding the required concentration of bacilli by the fractional method to a strong solution of serum is the same as that obtained by adding the bacilli all at one time to more dilute serum.

Below a certain level of concentration of bacteria there is no appreciable amount of agglutinin removed from the serum, and the stronger the solution of serum the greater the density of organisms required. Thus, with dysentery bacilli, in order to remove an appreciable amount of agglutinin from 0·1 cubic centimetre of serum with a titre of 1 in 4,000, made up to 1 cubic centimetre with saline (= dilution of T. $\times$ 400), over $1,000 \times 10^6$ organisms are required; and similarly $8,000 \times 10^6$ are required to remove 80 per cent; while with 0·01 cubic centimetre of the same serum made up to 1 cubic centimetre (= a dilution of T. $\times$ 40), over 100×10^6 organisms are required to remove an appreciable amount of agglutinin, and $1,500 \times 10^6$ to remove 80 per cent.

When performing the "absorption" of agglutinin test with dysentery bacilli, therefore, the ratio between the antigen and antibody should be not less than $1,500 \times 10^6$ bacilli to not more than 0·01 cubic centimetre of serum of a titre of 1 in 4,000 diluted 100 times, if concise and comparable specific results are to be obtained.

The alternative to the use of more dilute serum is to add the required concentration of organisms by fractions, but it is questionable whether the result in the shape of greater accuracy will justify the extra labour entailed.

It is interesting that the agglutinins can be removed almost completely from 0·1 cubic centimetre of serum by $6,000 \times 10^6$ bacilli when added by fractions, whereas $10,000 \times 10^6$ bacteria added all at one time fail to remove more than 90 per cent. This fact, together with the regularity of curve C, seems to be evidence of slightly greater accuracy being possible by the fractional addition of the antigen combined with greater dilution of the serum.

On the evidence of these experiments the following standards were chosen, the dilution method being used. With serum of a titre of 1 in 4,000, 0·006 cubic centimetre of serum was "absorbed" with $4,500 \times 10^6$ (counted) bacilli (equalling $3,000 \times 10^6$ bacilli by Brown's method), the total volume of fluid being three cubic centimetres (a dilution of T. $\times$ 8).

In the case of serum with a titre of 1 in 8,000 the amount of serum is halved, so that the final dilution bears the same relationship to the titre of the serum (T. × 8) as in the case of the lower titre serum. All other conditions remain the same. Should a serum be of so low a titre as 1 in 1,000 (i.e., one-quarter of that of the serum tested above), the amount of serum used is four times that used above, and other conditions remain as before.

It will be noticed that the amount of serum used is about three-fifths of the maximum, the dilution five times as high, and the number of bacilli three times the minimum indicated by the above curves. Thus a wide margin is allowed in the hope of reducing the error obviously indicated by the irregularity of curves A and B, fig. 1.

PART III.

RESULTS.

(a) *Agglutination with Normal Rabbit Serum.*

All the strains were tested as to their agglutinability with normal rabbit serum, with the results shown in Table III.

TABLE III.

	− 1 : 20	+ 1 : 20	+ 1 : 40	+ 1 : 60	+ 1 : 80	+ 1 : 100	Totals	Number of strains agglutinating	Percentage of strains agglutinating
Class 1 ..	6	2	0	0	1	0	9	3	33·3
Class 2 ..	6	0	0	0	0	0	6	0	0
Class 3 ..	17	10	3	1	1	1	33	16	48·48
Class 4 ..	1	0	3	1	0	0	5	4	80·0
Totals ..	30	12	6	2	2	1	53	23	..
Percentages	56·6	22·64	11·32	3·77	3·77	1·9	..	43·4	..

The number of strains agglutinating with normal rabbit serum is 43·4 per cent of all strains, and only 9·4 per cent agglutinate in dilutions higher than 1 in 40. The dilution which shows the end-point of the majority of agglutinating strains is 1 in 20, which was the lowest dilution used.

When Classes 1 and 3 are considered together only 45·24 per cent agglutinate with normal rabbit serum.

None of Class 2 are positive even in 1 in 20, while 80 per cent of Class 4 agglutinate between 1 in 20 and 1 in 60.

With some slight variations as to the agglutinating strains the figures were confirmed fairly well by the sera of two other rabbits. It would appear that the agglutinability of the dysentery group in normal rabbit serum is not very marked and is negligible as a factor in agglutination by specific sera.

The list of the strains which thus agglutinate and their end-points is given in the tables dealing with co-agglutination.

(*b*) *Co-agglutination.*

This subject is considered under three headings :—

(*a*) Agglutination of the dysentery group as far as it is represented by the fifty-three strains under examination, against sera prepared against the different classes.

(*b*) Agglutination between the various members of the non-mannite fermenting sub-groups (Classes 1 and 2).

(*c*) Agglutination occurring between the various members of the mannite frementing sub-groups (Classes 3 and 4).

TABLE IV. *

		Flexner Ledingham serum. Titre 1 : 4000	Y Ledingham serum Titre 1 : 8000	Logan serum Titre 1 : 4000	Shiga Dean I serum Titre 1 : 4000	Normal rabbit serum
Class 1	"Shiga" Ledingham	+100 (T. × 40)	+1,500 (T. × 5·3)	+ 500 (T. × 8)	..	+ 80
	104	−40 (T. × 100)	− 80 (T. × 100)	+40 (T. × 100)	..	− 20
	Blood	−40 (T. × 100)	− 80 (T. × 100)	+100 (T. × 40)	..	− 20
	Shiga Lister	+40 (T. × 100)	+ 100 (T. × 80)	+100 (T. × 40)	..	− 20
	Hagen	−40 (T. × 100)	− 80 (T. × 100)	+100 (T. × 40)	..	− 20
	Wainwright	−40 (T. × 100)	− 80 (T. × 100)	+ 80 (T. × 50)	..	− 20
	S. 7	+100 (T. × 40)	+ 2,000 (T. × 4)	+ 500 (T. × 8)	..	+ 20
	Dean I	+40 (T. × 100)	+ 500 (T. × 16)	+250 (T. × 16)	..	+ 20
	Dean II	−40 (T. × 100)	− 80 (T. × 100)	+ 80 (T. × 50)	..	− 20
Class 2	Haines	−40 (T. × 100)	− 80 (T. × 100)	−40 (T. × 100)	−40 (T. × 100)	− 20
	6	−40 (T. × 100)	− 80 (T. × 100)	−40 (T. × 100)	−40 (T. × 100)	− 20
	13	−40 (T. × 100)	− 80 (T. × 100)	+40 (T. × 100)	−40 (T. × 100)	− 20
	Whitby	−40 (T. × 100)	− 80 (T. × 100)	−40 (T. × 100)	−40 (T. × 100)	− 20
	Fletcher	−40 (T. × 100)	+ 80 (T. × 100)	+40 (T. × 100)	−40 (T. × 100)	− 20
	Harrison	−40 (T. × 100)	− 80 (T. × 100)	−40 (T. × 100)	−40 (T. × 100)	− 20

* Two other Class 3 sera gave exactly similar results with this class.

(*a*) The end-point of positive agglutination and the lowest dilution with which the negative strains were tested are given in Tables IV and V. In these tables a number preceded by a plus sign gives the highest dilution of the serum in which there was agglutination, and a number preceded by a minus sign indicates the lowest dilution of the serum in which the strain was tested and still remained negative. By comparing the normal serum

columns with the other columns of these tables it would appear that where strains agglutinate with the normal serum the positive reaction is due to some intrinsic property concerned with the bacilli themselves rather than to the sensitizing powers of the serum.

TABLE V.

	Shiga Dean I serum Titre 1 : 4000	Normal rabbit serum		Shiga Dean I serum Titre 1 : 4000	Normal rabbit serum	
Y Ledingham ..	+ 80 (T × 50)	+ 20	Gallipoli	+40 (T. × 100)	+ 60	Class 3
34 A...	−40 (T. × 100)	+ 40	Oxford Flexner ..	−40 (T. × 100)	+ 20	
Maltos	−40 (T. × 100)	+ 20	Oxford Y	−40 (T. × 100)	+ 40	
Constance	−40 (T. × 100)	+ 20	Mountain.. ..	−40 (T. × 100)	+ 20	
P. B. 24	−40 (T. × 100)	+ 40	Mahamid Ali ..	+250 (T. × 16)	+ 100	
P. B. 27	−40 (T. × 100)	+ 20	Karim Khan ..	+100 (T. × 40)	+ 80	
1609	−40 (T. × 100)	+ 20	Chuna Famlia ..	−40 (T. × 100)	+ 20	
6067	−40 (T. × 100)	+ 20	Rama Cooly ..	−40 (T. × 100)	+ 20	
Flexner Ledingham	+40 (T. × 100)	+ 40	67 B.	+40 (T. × 100)	+ 40	Class 4
Y Lister	+40 (T. × 100)	− 20	86 A.*	..	+ 80	
19 A...	+40 (T. × 100)	+ 40	.. .. ..	..	..	

* This strain was not tested against Dean I serum.

Only strains which give a positive result with either of these sera are included in this table; the rest of the strains of Class 3 were negative with both sera.

There is considerable agglutination of the strains in Class 1 by relatively low dilutions of the sera produced by Classes 3 and 4. But one strain only (S. 7) agglutinates in a dilution which may be considered to come within the range of specific agglutination on the evidence to be considered on pp. 367-373. The Class 3 sera used are highly representative, as will be shown later, and the Class 4 serum (Flexner Ledingham) agglutinates all the strains of that class almost to titre. The strains which consistently agglutinate most highly with these sera are also those which agglutinate with normal rabbit serum. The strains of Class 2 hardly agglutinate with the sera of Class 1, 3 and 4; two only agglutinate in a dilution of T. × 100. In Class 3 only 12 per cent of strains agglutinate in a dilution of T. × 100 with a good agglutinating Class 1 serum.

With no Class 3 strain does agglutination occur in Class 1 serum within the range of specific agglutination in terms of the evidence referred to above, and which is yet to be considered. One very agglutinable strain agglutinates in a dilution of T. × 16. All Class 4 strains agglutinate in a dilution of T. × 100 with the Class 1 serum, but none reach a higher dilution.

Two attempts to produce a high titre serum against Class 2 strains were not very successful, a titre of only 1 in 1,000 being obtained on both occasions. The degree of agglutination with these sera against strains of Classes 1, 3, and 4 was within the range of normal rabbit serum agglutination, which it followed closely.

The evidence from the writings of other authors, with the exception of

Kruse, does not agree with the results shown in Tables IV and V, as will be seen from the following extracts :—

Kruse: "True dysentery" bacilli are agglutinated feebly, or not at all, by the "pseudo-dysentery" sera. The "pseudo-dysentery" strains are even less agglutinable by the "Shiga-Kruse" sera.

Nicolle, Debains, and Jouan: The serum produced by the "original Shiga" agglutinates the "original Flexner" bacillus more strongly than the "Shiga" bacillus.

Nicolle, Debains, and Loiseau: Normal rabbit serum does not agglutinate "Shiga," but it agglutinates "Flexner" slightly. The mannite fermenters agglutinate with both "Shiga" and "Flexner" sera.

Kuennen: "Shiga" serum agglutinates "Shiga" and "pseudo-dysentery" strains equally well.

Friedmann and Steinbock: "Shiga" serum will agglutinate the Flexner group, but the converse does not hold good.

Debains: *B. dysenteriæ* "Y" agglutinates with "Flexner-Y" and "Shiga" sera, and to less extent with normal horse serum.

Lancelin and Rideau: Flexner infections with co-agglutination for "Shiga" are rare. The converse is more common.

Friedmann: It is impossible to distinguish "Shiga" and "Y" serologically, as sera of "Shiga" patients often agglutinate "Y" exclusively.

(*b*) Co-agglutination between the various members of the sub-groups of the non-mannite fermenters :—

As has been shown in Table IV (p. 363) there is no group-agglutination between the strains of Classes 1 and 2, even in a dilution of 1 in 40 of a serum with a titre of 1 in 4,000 (= a dilution of T. × 100). Thus these classes can justly be considered as specifically distinct.

It will be shown later that the strains of Class 1 (true "Shiga") all "absorb" the agglutinins from the serum prepared against any single member of the class. They can, therefore, all be considered as belonging to one antigenic type, and for practical purposes all their agglutinins may be looked upon as specific.

TABLE VI.

Dilution of serum Titre 1 : 4000	Number of strains agglutinating Eight strains used	Percentage of strains agglutinating
T. × 16	8	100
T. × 8	8	100
T. × 4	8	100
T. × 2	7	75
T. × 1·3	5	63
T. × 1	4	50

The following experiment is based upon this fact. A serum prepared against "Dean I" strain (titre 1 in 4,000) was used to test the agglutin-

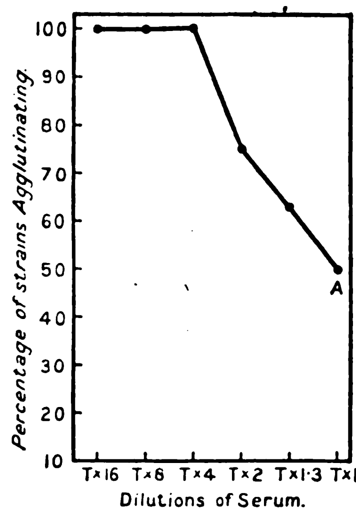
ability of the remaining eight strains of Class 1 in dilutions of T. × 16, T. × 8, T. × 4, T. × 2, T. × 1·3 and T. × 1. The strain used in preparing the serum is ignored in the consideration of the result as it naturally agglutinated to titre. The results of this experiment are shown in Table VI.

These percentages are expressed in the form of a curve in fig. 2, curve A.

Now, since eight strains agglutinated in the dilution T. × 4 the percentages of strains agglutinating in the higher dilutions, when only strains agglutinating in T. × 4 are considered, will be the same as in the case of those agglutinating in the dilution T. × 16; thus the curves will be identical.

If only strains agglutinating in higher dilutions than T. × 4 are considered in turn, the general level of each successive curve will rise until only strains reaching titre are used, when the curve will remain at 100 per cent throughout.

Fig. 2.



(Shiga Serum.)
Table VI.

Thus the higher the curve, the more specific are the agglutinins under consideration—the less specific agglutinins having been diluted out. The curve produced by this experiment is taken to represent specific agglutination, and is of importance in the consideration of the mannite-fermenting sub-group.

Class 2.—It has already been noticed that there is no group agglutination between Classes 1 and 2. Although there was some variation in the agglutinability of different strains with sera prepared against strains in this class, all the strains "absorbed" agglutinins for the homologous strain from the sera. Unfortunately both the Class 2 sera prepared were of low titre (1 in 1,000).

(*c*) Co-agglutination between the strains of the mannite-fermenting sub-group :—

The following experiments were performed with members of the mannite-fermenting sub-group, in order to show the degree to which the serum should be diluted to get clear of the majority of group agglutinins.

A serum prepared against the "Y-Ledingham" strain (titre 1 in 8,000) was used to test eleven strains of Class 3 other than the homologous strain.

A "Logan" serum (titre 1 in 4,000) was used against eleven strains of Class 3 other than "Logan."

A "Flexner Lister" serum (titre 1 in 4,000) was used against twenty-four strains of Class 3 other than "Flexner Lister."

These strains were not selected in any way. Eleven of them were used against all three sera, and thirteen additional ones were used against "Flexner" Lister serum. The results obtained are shown in Table VII :—

TABLE VII.

	Y Ledingham serum Titre 1 : 8000 against 11 strains		Logan serum Titre 1 : 4000 against 11 strains		Flexner Lister serum Titre 1 : 4000 against 24 strains	
Dilutions of serum	Number of strains agglutinating	Percentage of strains agglutinating	Number of strains agglutinating	Percentage of strains agglutinating	Number of strains agglutinating	Percentage of strains agglutinating
T. × 16	10	91	9	82	24	100
T. × 8	10	91	9	82	19	79
T. × 4	8	73	9	82	15	68
T. × 2	6	55	6	55	11	46
T. × 1·3	4	36	4	36	11	46
T. × 1	3	18	4	36	9	37

Now, in the same experiment, when those strains only which agglutinate in a dilution of T. × 4 are considered, the number of strains agglutinating in the different dilutions are as shown in Table VIII :—

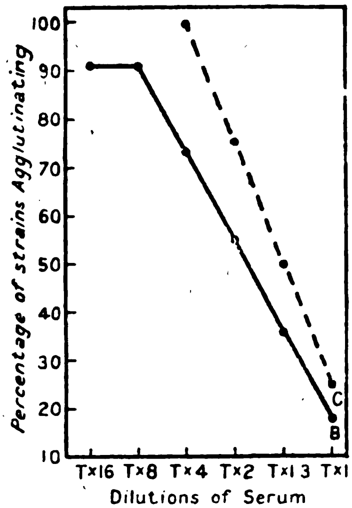
TABLE VIII.

Considering only Strains agglutinating in Dilution of T. × 4.

	Y" Ledingham serum Titre 1 : 8000 against 8 strains		Logan serum Titre 1 : 4000 against 9 strains		Flexner Lister serum Titre 1 : 4000 against 15 strain	
	Number of strains agglutinating	Percentage of strains agglutinating	Number of strains agglutinating	Percentage of strains agglutinating	Number of strains agglutinating	Percentage of strains agglutinating
T × 4 ..	8	100	9	100	15	100
T × 2 ..	6	75	6	67	11	73
T × 1·3..	4	50	4	44	11	73
T × 1 ..	3	25	4	44	9	60

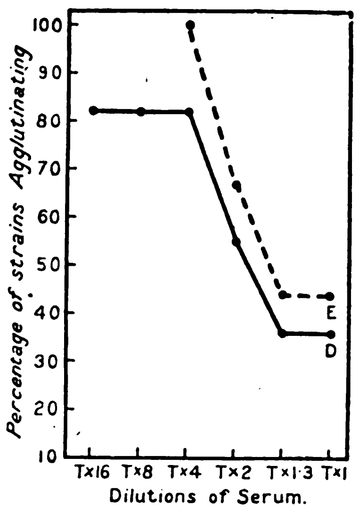
When these results are considered, it is seen that the figures for the three sera in Table VII agree with one another quite well, and that the figures in Table VIII also agree with one another equally well. It is

FIG. 3.



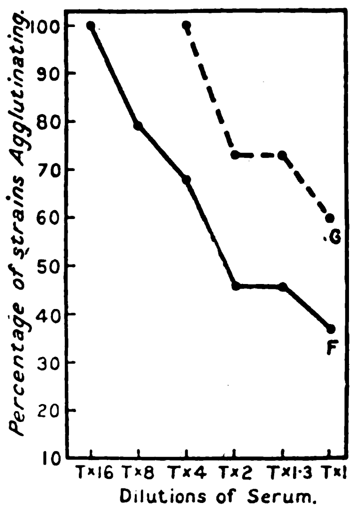
(Y Ledingham Serum.)
B = Table VII.
C -- Table VIII.

FIG. 4.



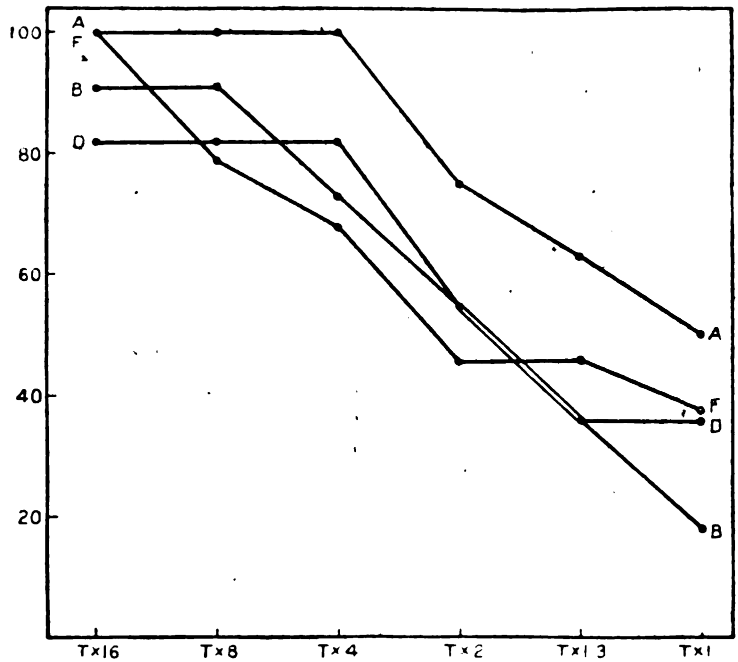
(Logan Serum.)
D = Table VII.
E = Table VIII.

FIG. 5.



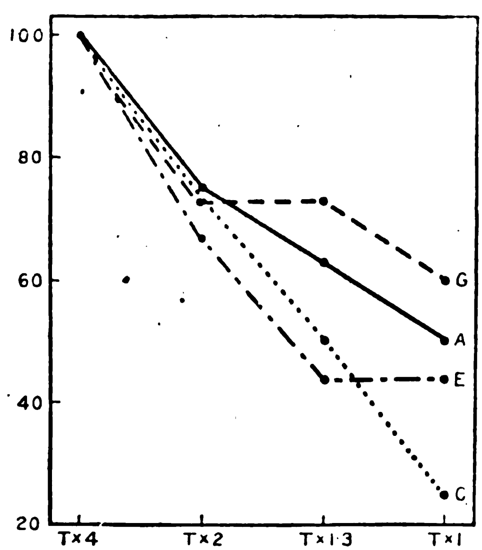
(Flexner Lister Serum.)
F = Table VII.
G = Table VIII.

FIG. 6.



Curve A = Shiga (Table VI).
Curve B = Y Ledingham (Table VII).
Curve D = Logan (Table VII).
Curve F = Flexner Lister (Table VII).

FIG. 7.



Curve A = Shiga (Table VI).
Curve C = Y Ledingham (Table VIII).
Curve E = Logan (Table VIII).
Curve G = Flexner-Lister (Table VIII).

evident also that the figures of Table VIII agree very closely with those obtained in the experiment with the "true Shigas" in Table VI.

These points are made more evident by expressing the percentages in the form of curves, and this has been done in figs. 3, 4, and 5. In these curves it will be noticed that the general level of the curves from Table VIII remain higher than that of the curves from Table VII. In this connexion it was suggested above (p. 366) that the higher the general level of the curve the more specific was the agglutination reaction under consideration, owing to the less specific agglutinins having been diluted out. This conclusion is emphasized by superimposing the curves from Table VII and those from Table VIII, and comparing both sets with the curve from Table VI.

This has been done in figs. 6 and 7, where it will be noticed that the curves from Table VII fall below the "true Shiga" curve, whereas the curves from Table VIII agree very well with that curve. Reasons have already been given for believing that the "Shiga" curve represents specific agglutination (p. 365).

Such divergence as exists between curves A, C, E, and G in fig. 7, are probably due to the more or less successful diluting out of the group agglutinins, and to a less extent, perhaps, to individual variation in the agglutinability of the strains.

These same experiments afford evidence of another kind which seems to show that the higher the curve the more specific is the agglutination under consideration.

TABLE IX.

	Types of agglutination						Number of times the type occurs with each serum				Totals
	T. × 16	T. × 8	T. × 4	T. × 2	T. × 1·3	T. × 1	Dean I	Logan	Flexner Lister	Y Ledingham	
1	+++	+++	+++	+++	+++	+++	2	4	9	3	18
2	+++	+++	+++	+++	+++	++	1	1	0	0	2
3	+++	+++	+++	+++	+++	+	1	0	0	0	1
4	+++	+++	+++	+++	++	+	1	0	1	1	3
5	+++	+++	+++	++	+	—	0	2	1	1	4
6	+++	+++	+++	+	+	—	1	0	0	0	1
7	+++	+++	+++	+	—	—	1	0	0	2	3
8	+++	+++	+++	—	—	—	2	1	1	0	4
9	+++	+++	++	—	—	—	0	1	2	1	4
10	+++	+++	+	—	—	—	0	1	2	1	4
11	+++	+++	—	—	—	—	0	0	1	0	1
12	+++	+	—	—	—	—	0	0	3	1	4
13	+++	—	—	—	—	—	0	0	5	1	6
14	—	—	—	—	—	—	0	2	0	1	3

Agglutinations were done in dilutions of T. × 16, T. × 8, T. × 4, T. × 2, T. × 1·3 and T. × 1, with the following sera and strains:—

"Dean I" serum (titre 1 in 4,000) against 9 strains of Class 1.

"Logan" serum (titre 1 in 4,000) against 12 strains of Class 3.

"Flexner" Lister serum (titre 1 in 4,000) against 25 strains of Class 3.

"Y Ledingham" serum (titre 1 in 8,000) against 12 strains of Class 3.

As there is some "overlapping" in the strains of Class 3 what really happens in the above experiment is that three sera belonging to Class 3 are being used against twenty-seven different strains of that class.

These experiments gave the results shown in Table IX and the percentage in Table X. The percentage for a given strain in any dilution is arrived at by counting the pluses in that and the higher dilutions and comparing them with the number of pluses given by the homologous strain in the same dilutions.

TABLE X.

	T. × 16	T. × 8	T. × 4	T. × 2	T. × 1·3	T. × 1
1	100	100	100	100	100	100
2	94	93	92	89	83	67
3	89	87	83	78	67	33
4	83	80	75	67	50	33
5	67	60	50	33	17	0
6	61	53	42	22	17	0
7	56	47	33	11	0	0
8	50	40	25	0	0	0
9	44	33	11	0	0	0
10	39	22	6	0	0	0
11	33	12	0	0	0	0
12	22	7	0	0	0	0
13	17	0	0	0	0	0
14	0	0	0	0	0	0

These figures can be treated in two ways:—

(1) They can be charted to show the general level of agglutination maintained by the different types of agglutination through the various dilutions of the serum (fig. 8).

(2) The curves can be drawn to show the relationship of the percentage of agglutination in any one dilution to the percentage of agglutination in some other dilution of serum. This has been done in fig. 9, where the relationship of the percentage of agglutination in a dilution of T. × 16 to the percentage in the dilutions of T. × 8, T. × 4, T. × 2, T. × 1·3, and T × 1 are shown. Each of the curves in this figure represents a separate dilution of serum.

In both figs. 8 and 9 it will be noticed that the more specific the agglutination the higher is the general level maintained by the curve, i.e., a strain agglutinating to a high degree, when the percentage is calculated from a low dilution, will maintain its high level throughout the various dilutions up to the titre of the serum. On the other hand, in the case of a strain which agglutinates to a low degree when the percentage is calculated from a lower dilution of serum, the curve will fall rapidly and give a negative result in dilutions containing a relatively large amount of serum.

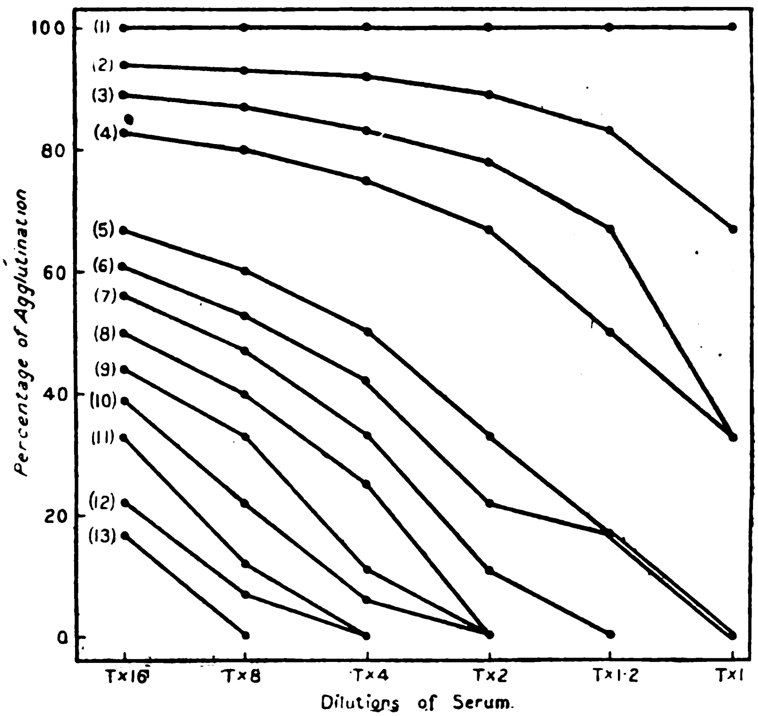


FIG. 8.—The numbers in brackets refer to the types of agglutination in Tables IX and X.

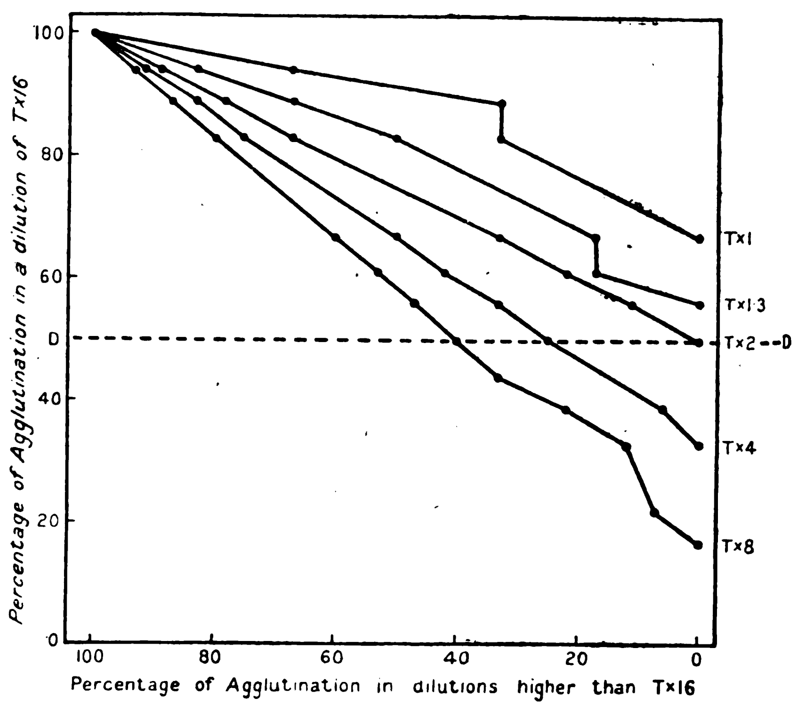


FIG. 9.

In the second Case, as the agglutination does not maintain its level, it can justly be called group agglutination.

In this connexion it must be noted, that when percentages of agglutination calculated for strains which only agglutinate to an extent which might be called a group reaction are compared with the homologous strain for the serum used, should many dilutions be included within the positive range of action of the heterologous strain, the group reaction will assume such large proportions that it might be confused with specific agglutination. To avoid falling into an error of this nature it became essential to choose a dilution of serum as a standard which would preserve the characteristic of having the group agglutinins diluted out as much as possible, and yet permit of a sufficient range of dilutions ere the titre of the serum was attained.

The line D—D in fig. 9 shows the lowest level reached by any of the nine "Shiga" strains used in the experiment furnishing the curves, and it will be noticed that this line cuts the curve given by dilution T. × 4 very close to where that curve reaches zero. Also that the general trend of the curves for the dilutions higher than T. × 4 is to reach zero above the level of the line D—D. On the other hand, the general direction of the curve given by the dilution T. × 8 tends to reach zero very much below the line D—D, and lower dilutions than this, of course, fall more rapidly.

In examining fig. 8, it will be noticed that curve 8 corresponds to the line D—D in fig. 9, and when this fact is borne in mind the conclusions drawn from fig. 8 agree with those deduced from fig. 9 and Tables VI, VII and VIII. That is to say, the dilution T. × 4 gives results which seem to show very little interference by group agglutination, and, as it still leaves a wide range of higher dilutions, this dilution would seem to satisfy the required conditions and is used as the base line of specific agglutination.

To limit "specific" agglutination to dilutions not lower than T. × 4 might appear to be setting rather a high standard, in spite of the evidence on which it is based. Nevertheless, it is borne out by the results given in Tables IV and V, where it will be noticed that in no case did any strain agglutinate in a higher dilution than T. × 4, and that only one strain (S. 7 with Y-Ledingham serum) reached that dilution. The agglutinations in these two tables can be called "group agglutinations" without any hesitation on the evidence of the "absorption" of agglutinin reaction and other evidence collected by various authors. On the other hand, where, given an appropriate serum, we might rightly expect specific agglutination, such always occurs above a dilution of T. × 4. This has been seen in Table VI and will be shown later when specific agglutination with the mannite fermenters is discussed.

(c) Castellani's "Absorption" of Agglutinin Reaction.

The technique employed in applying this test has been discussed in Part II of this paper (p. 358). To what has already been said there it is only

necessary to add that when a serum has been "absorbed" by a given strain it was tested against the homologous strain in dilutions of T. × 4, T. × 2, T. × 1·3 and T. × 1 only. That is to say, the dilutions of the serum used only reacted within the range of what I consider to be specific agglutination, on the evidence discussed in the last section.

(1) *Class* 1.—The true "Shigas" vary in their agglutinability, as will have been noticed in the discussion of group agglutination, and is well shown in curve A of fig. 2 which shows the percentage of strains agglutinating in different dilutions of a serum prepared against the "Dean I" strain.

With an old serum prepared against another strain ("Shiga" "Ledingham"), only one strain besides "Shiga" "Ledingham" agglutinated in a dilution of T. × 4. Nevertheless, all the strains of Class 1 "absorbed" the agglutinins for the homologous strain from both of these sera. Class 1 strains do not "absorb" the agglutinins from sera produced by strains of Classes 2, 3 and 4.

Though all the "Shiga" strains will "absorb" the agglutinins from any Class 1 serum, it should be noted that there is some variation in the agglutinating power of individual sera towards different members of the "Shiga-Kruse" group, in addition to the differences of agglutinability exhibited by the various strains already referred to. (This is also true of Class 2). It is evident that "Shiga-Kruse" forms a well-defined species perfectly distinct from the mannite-fermenting group and the "Schmitz" group of dysentery bacilli. This is in agreement with the conclusions of Shiga, Flexner, Gay, Kruse, Levy, Kolle, Hetsch, Kuenen, Schmitz, and others, and is contradictory to Ohno's conclusions.

(2) All the *Class* 2 strains fail to agglutinate with sera prepared against strains of Classes 1, 3 and 4, nor do they "absorb" the agglutinins from any of these sera. Nevertheless, the agglutinins are absorbed to a high degree by all members of Class 2 from sera prepared from strains of the same class. The class as a whole behaves in the same way as does Class 1. (So far it has proved difficult to produce a Class 2 serum of high titre, as the great toxicity of these bacilli for rabbits prevents the use of large doses.)

Thus the organisms comprised by Class 2 are specifically distinct from the true "Shiga-Kruse" in every respect except in the characters considered in Table I. In the production of indol and their behaviour with Michaelis's acid agglutination they agree with what Andrewes describes as *B. ambiguus*. Further, they are in agreement with the description of *B. dysenteriæ* "Schmitz" discussed on p. 265 of the Introduction to this paper, which was the causal agent of quite a considerable epidemic. As has been mentioned, they are very toxic for rabbits; indeed, they are more toxic for these animals than any of my nine strains of "Shiga," and they produce the same typical lesions caused by fatal doses of dysentery

bacilli. As there is sufficient evidence of their pathogenicity for man in the papers published by Schmitz, they must be included in the true dysentery group. The name given to this type of organism by Abel, though not eminently satisfactory, has the right of priority over Andrewes' *B. ambiguus*.

This group forms a species distinct from both "Shiga-Kruse" and the mannite fermenters. This paper in a small way, is confirmatory of Schmitz's work on the agglutination and absorption reactions with this group of dysentery bacilli.

TABLE XI.

Y Ledingham Serum (Titre 1 : 8000)

	Unabsorbed serum				Absorbed serum							
	v. Test strains				v. Y Ledingham				v. Test strains			
	1 : 2000 T. × 4	1 : 4000 T. × 2	1 : 6000 T. × 1·3	1 : 8000 T. × 1	1 : 2000 T. × 4	1 : 4000 T. × 2	1 : 6000 T. × 1·3	1 : 8000 T. × 1	1 : 2000 T. × 4	1 : 4000 T. × 2	1 : 6000 T. × 1·3	1 : 8000 T. × 1
Y Ledingham	+++	+++	+++	+++	–	–	–	–	..	..	..	..
Gallipoli ..	+++	+++	+++	–	+++	–	–	–	–	–	–	–
34 A.* ..	+++	++	+	–	+++	++	+	+	–	–	–	–
6066 ..	+++	++	+	–	+++	+++	+	+	–	–	–	–
1210 ..	+++	+++	–	–	+++	+++	+++	+++	–	–	–	–
Y Lister ..	+++	+	–	–	–	–	–	–	–	–	–	–
Constance‡	+++	–	–	–	+++	–	–	–	–	–	–	–
P. B. 27 ..	+++	+	–	–	+++	+	–	–	–	–	–	–
Marginson‡	+++	+	–	–	+++	+++	+	+	–	–	–	–
Maltos* ..	++	+	–	–	+++	++	++	+	–	–	–	–
Flexner Lister	+++	–	–	–	+++	–	–	–	–	–	–	–
6091 ..	++	+	–	–	+++	+++	+++	–	–	–	–	–
1609 ..	++	+	–	–	+++	+++	+++	++	–	–	–	–
6067 ..	++	–	–	–	+++	+++	++	–	–	–	–	–
Humphries*	+	–	–	–	+++	+++	++	+	–	–	–	–
P. B. 23 ..	+	–	–	–	+++	+++	++	+	–	–	–	–
P. B. 24 ..	+	–	–	–	+++	+++	++	+	–	–	–	–
1460 ..	+	–	–	–	+++	+++	+++	+++	–	–	–	–
Toner* ..	–	–	–	–	+++	+++	+	+	–	–	–	–
Sincos‡ ..	–	–	–	–	+++	+++	+	–	–	–	–	–
Ogg‡ ..	–	–	–	–	+++	+++	++	–	–	–	–	–
Logan ..	–	–	–	–	+++	+++	+++	++	–	–	–	–

The strains Flexner Ledingham, 19 A., 67 B., 86 A. and D. J. failed to agglutinate with or "absorb" the agglutinins from this serum.

* = When these strains were tested Y Ledingham agglutinated as follows with this serum: 1 : 2000 +++, 1 : 4000 +++, 1 : 6000 +++, 1 : 8000 ++.

‡ = When these strains were tested this serum agglutinated Y Ledingham as follows: 1 : 2000 +++, 1 : 4000 +++, 1 : 6000 ++, 1 : 8000 +.

(3) *The Mannite-fermenting Group* (*Classes* 3 *and* 4).—None of the strains comprised by these classes "absorb" the agglutinin from either Class 1 or Class 2 sera, and the converse is also true. Twenty-seven strains were tested against three different sera of this group, and fourteen of these strains were tested against a fourth serum. The details of the strains and

sera used are given with the results of the tests in Tables XI, XII, XIII and XIV. The readings given by strains which failed to agglutinate or absorb the agglutinins from any of the four sera are not given in full in order to avoid over-burdening the tables.

TABLE XII.

LOGAN SERUM. (TITRE 1 : 4000)

	Unabsorbed serum				Absorbed serum							
	v. Test strains				v. Logan				v. Test strains			
	1 : 1000 T. × 4	1 : 2000 T. × 2	1 : 3000 T. × 1·3	1 : 4000 T. × 1	1 : 1000 T. × 4	1 : 2000 T. × 2	1 : 3000 T. × 1·3	1 : 4000 T. × 1	1 : 1000 T. × 4	1 : 2000 T. × 2	1 : 3000 T. × 1·3	1 : 4000 T. × 1
Logan ..	+++	+++	+++	+++	–	–	–	–	..	..	..	..
P. B. 27 ..	+++	+++	+++	+++	–	–	–	–	–	–	–	–
D. J. ..	+++	+++	+++	+++	–	–	–	–	–	–	–	–
Marginson	+++	+++	+++	+++	–	–	–	–	–	–	–	–
Humphries	+++	+++	+++	+++	–	–	–	–	–	–	–	–
1210 ..	+++	+++	+++	++	–	–	–	–	–	–	–	–
6091 ..	+++	+++	+++	++	–	–	–	–	–	–	–	–
Maltos ..	+++	+++	+++	++	–	–	–	–	–	–	–	–
6067 ..	+++	+++	+++	++	+++	+++	–	–	–	–	–	–
1609 ..	+++	+++	+++	+	–	–	–	–	–	–	–	–
Y Ledingham	+++	++	+	–	++	–	–	–	–	–	–	–
34 A. ..	+++	++	–	–	+++	+	–	–	–	–	–	–
Gallipoli ..	+++	+	–	–	+++	+++	+	–	–	–	–	–
6066 ..	++	+	–	–	+++	+++	+++	++	–	–	–	–
P. B. 24 ..	++	+	–	–	+++	+++	+++	++	–	–	–	–
P. B. 23 ..	+	+	–	–	+++	+++	++	+	–	–	–	–
Constance	+	+	–	–	+++	+++	+++	++	–	–	–	–
Flexner Lister	+	–	–	–	+++	+++	+++	++	–	–	–	–

Flexner Ledingham, Y Lister, 19 A., 67 B., 86 A., Ogg, Toner, Sincos, and 1460 all failed to agglutinate with, or "absorb" any agglutinin from this serum.

TABLE XIII.

FLEXNER LEDINGHAM SERUM (TITRE 1 : 8000).

	Unabsorbed serum				Absorbed serum							
	v. Test strains				v. Flexner Ledingham				v. Test strains			
	1 : 2000 T. × 4	1 : 4000 T. × 2	1 : 6000 T. × 1·3	1 : 8000 T. × 1	1 : 2000 T. × 4	1 : 4000 T. × 2	1 : 6000 T. × 1·3	1 : 8000 T. × 1	1 : 2000 T. × 4	1 : 4000 T. × 2	1 : 6000 T. × 1·3	1 : 8000 T. × 1
Flexner Ledingham	+++	++	+	+	–	–	–	–	..	..	..	..
67 B. ..	+++	++	+	+	–	–	–	–	–	–	–	–
19 A. ..	++	++	+	+	–	–	–	–	–	–	–	–
Y Lister ..	++	++	+	+	+	–	–	–	–	–	–	–
86 A. ..	++	+	+	+	+	–	–	–	–	–	–	–

Y Ledingham, Flexner Lister, 34 A., Maltos, Humphries, Marginson, Ogg, Constance, Toner, Sincos, D. J., P. B. 23, P. B. 24, P. B. 27, Logan, Gallipoli, 6066, 6067, 6091, 1210, 1460 and 1609 neither agglutinated with nor "absorbed" any agglutinin from this serum.

TABLE XIV.

	Flexner Lister Serum (Titre 1 : 4000)											
	Unabsorbed serum				Absorbed serum							
	v. Test strains				v. Flexner Lister				v. Test strains			
	1 : 1000 T. × 4	1 : 2000 T. × 2	1 : 3000 T. × 1·3	1 : 4000 T. × 1	1 : 1000 T. × 4	1 : 2000 T. × 2	1 : 3000 T. × 1·3	1 : 4000 T. × 1	1 : 1000 T. × 4	1 : 2000 T. × 2	1 : 3000 T. × 1·3	1 : 4000 T. × 1
Flexner Lister	+++	+++	+++	++	–	–	–	–	..	..	..	..
34 A. ..	+++	+++	+++	++	–	–	–	–	–	–	–	–
Constance	+++	+++	+++	+	–	–	–	–	–	–	–	–
Y Ledingham	+	–	–	–	+++	+++	+++	+	–	–	–	–
Y Lister ..	–	–	–	–	+++	+++	+++	+	–	–	–	–

Flexner Ledingham, 19 A., 67 B., 86 A., Maltos, Humphries, Ogg, Toner, and Sincos all failed to agglutinate or "absorb" any agglutinin from this serum.

TABLE XV.

		Y Ledingham serum		Logan serum		Flexner Lister serum		Flexner Ledingham serum	
		Percentage of agglutination	Percentage of agglutinins absorbed	Percentage of agglutination	Percentage of agglutinins absorbed	Percentage of agglutination	Percentage of agglutinins absorbed	Percentage of agglutination	Percentage of agglutinins absorbed
Class 3	Y Ledingham	100	100	50	83	9	9	0	0
	34 A... ..	56	36	41	33	100	100	0	0
	Flexner Lister	25	75	8	8	100	100	0	0
	Maltos ..	27	27	92	100	0	0	0	0
	Humphries ..	9	18	100	100	0	0	0	0
	Marginson ..	33	11	100	100	—	—	0	0
	Ogg	0	11	0	0	0	0	0	0
	Constance ..	33	67	17	8	92	100	0	0
	Toner ..	0	27	0	0	0	0	0	0
	Sincos ..	0	22	0	0	0	0	0	0
	D. J... ..	0	0	100	100	—	—	0	0
	P. B. 23 ..	8	25	17	25	—	—	0	0
	P. B. 24 ..	8	25	25	8	—	—	0	0
	P. B. 27 ..	33	67	100	100	—	—	0	0
	Logan ..	0	8	100	100	—	—	0	0
	1609	25	8	83	100	—	—	0	0
	6066	50	33	25	8	—	—	0	0
	6067	17	33	92	50	—	—	0	0
	1210	50	0	92	100	—	—	0	0
	6091	25	25	92	100	—	—	0	0
	1460	8	0	0	0	—	—	0	0
	Gallipoli ..	75	75	33	42	—	—	0	0
Class 4	Flexner Ledingham	0	0	0	0	0	0	100	100
	Y Lister ..	33	100	0	0	0	9	86	86
	19 A... ..	0	0	0	0	0	0	86	100
	67 B... ..	0	0	0	0	0	0	100	100
	86 A... ..	0	0	0	0	0	0	71	86
		Class 3						Class 4	

— = Not tested. 0 = No agglutination or no "absorption" of agglutinins.

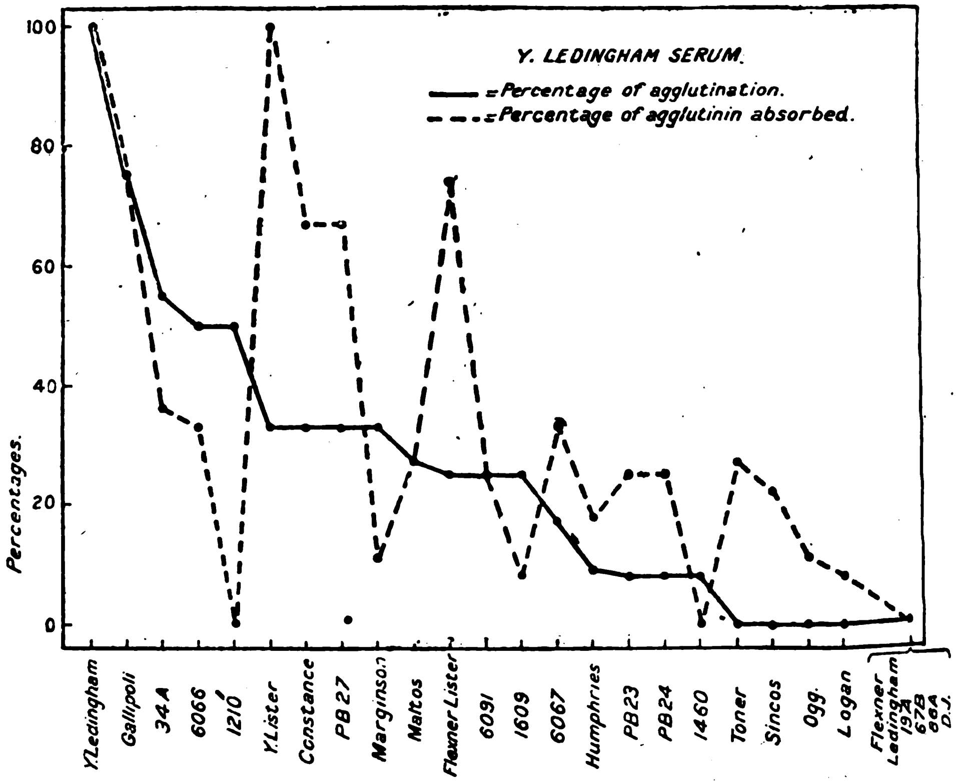

Y. LEDINGHAM SERUM.
=Percentage of agglutination.
=Percentage of agglutinin absorbed.
Percentages.
100
80
60
40
20
0
Y.Ledingham
Gallipoli
34A
6066
1210
Y.Lister
Constance
PB 27
Marginson
Maltos
Flexner Lister
6091
1609
6067
Humphries
PB23
PB24
1460
Toner
Sincos
Ogg.
Logan
Flexner
Ledingham
19A
67B
88A
D.J.

FIG 10.

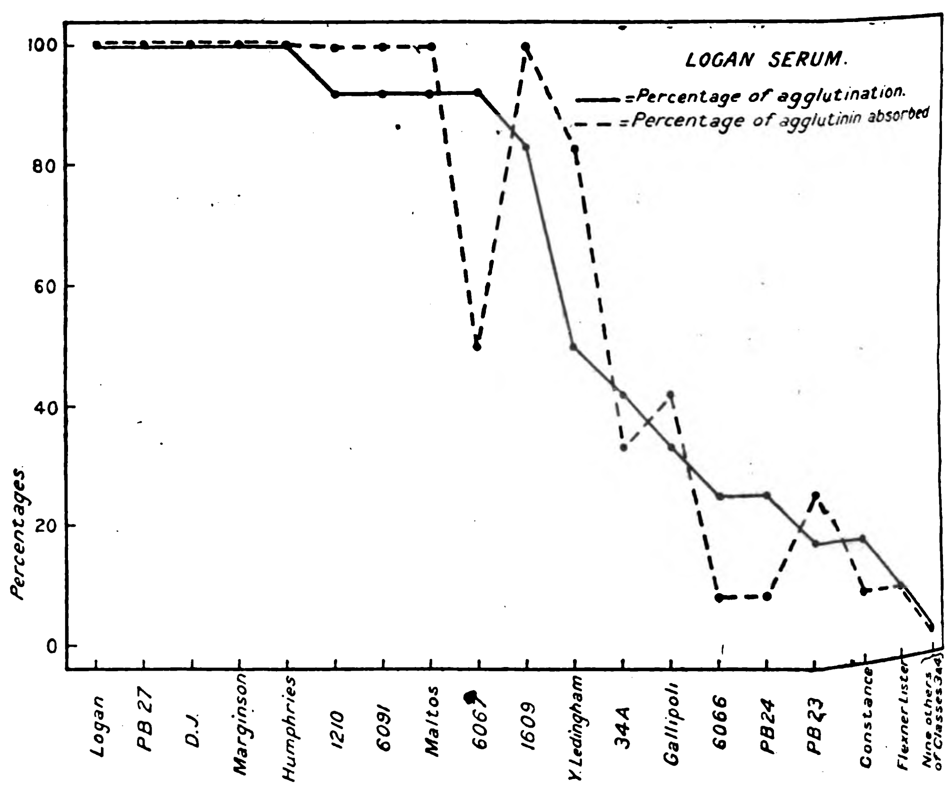
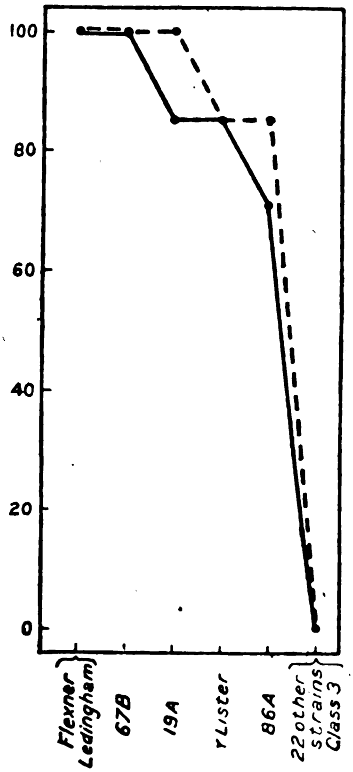

LOGAN SERUM.
=Percentage of agglutination.
=Percentage of agglutinin absorbed
Percentages.
100
80
60
40
20
0
Logan
PB 27
D.J.
Marginson
Humphries
1210
6091
Maltos
6067
1609
Y.Ledingham
34A
Gallipoli
6066
PB24
PB 23
Constance
Flexner Lister
Nine others of Classes 3&4

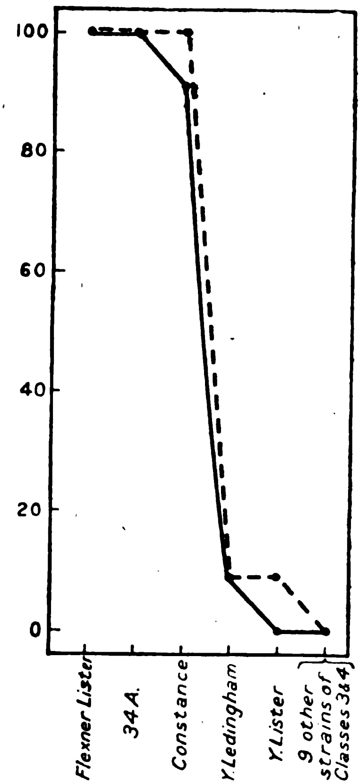
FIG. 11.

In examining these tables the outstanding feature is the isolated position of the Class 4 strains. Of these, "Y-Lister" is the only one which agglutinates or "absorbs" the agglutinins from any of the Class 3 sera, and it is only with the Y-"Ledingham" serum that this is at all marked; this strain completely "absorbs" the agglutinin for Y-"Ledingham" from the serum. (Y-Lister ferments lactose more slowly than the other Class 4 strains, and on occasions fails to ferment that sugar (Gruebler) even in



FLEXNER LEDINGHAM SERUM.
——— = Percentage of agglutination
– – = Percentage of agglutinin absorbed

FIG. 12.



FLEXNER LISTER SERUM.
——— = Percentage of agglutination.
– – = Percentage of agglutinin absorbed.

FIG. 13.

twenty-one days, though sometimes doing so in forty-eight hours.) Moreover, only the Class 4 strains agglutinate with or "absorb" the agglutinins from the serum of that class. It will be shown later that all the Class 4 strains agglutinate slightly with a serum prepared against another Class 3 strain (Toner). Another striking point is that not one of the Class 3 strain absolutely failed either to agglutinate with or "absorb" the agglutinins from one of the two Class 3 sera with which all of them were tested. Of those

which come very near to failure, as will be shown later, Ogg, Sincos and Toner, all three agglutinate completely, and 1,460 agglutinates highly with a Toner serum.

But when the results shown in Tables XI to XIV are worked out in percentages by counting the pluses, and the percentage of agglutination is compared with the percentage of agglutinin absorbed, the more important results of these experiments are revealed. This has been done in Table XV, and the figures so obtained are shown in graphic form in figs. 10, 11, 12 and 13. The curves showing the percentage of agglutination of the various strains with a given serum (continuous line) and that showing the percentage of agglutinin "absorbed" by the various strains from the serum (interrupted line) are superimposed.

In comparing these figures and curves it will be noticed :—

(1) That for practical purposes the "absorption" of agglutinin test shows little advantage over the simple agglutination test, even though the "absorption" test shows that the majority of strains form the antibody-antigen complex to a higher degree than is revealed by the flocculation of the test strains in the ordinary agglutination test.

(2) That the Class 3 strains, with sera of the same class (figs. 10, 11 and 13), are not divided into any semblance of grouping even by the very delicate "absorption" test, but that there exists every degree of agglutination and "absorption" of agglutinins, resulting in a gradually falling curve.

(3) That the Class 4 strains, with the exception of "Y-Lister" when tested with Class 3 sera are invariably to be found in the part of the curve showing a negative result (figs. 10, 11 and 13). But when these strains are tested with a Class 4 serum they are found without exception to agglutinate very highly and to "absorb" over eighty-five per cent of agglutinins from the serum (fig. 12).

(4) That all the Class 3 strains give negative results with the Class 4 serum (fig. 12).

When it is remembered that the agglutinins under consideration are of a high specific character (see pp. 365 to 373), and that the technique employed in performing the test has been devised to balance the complex factors controlling the reaction, in as far as it is possible to do so (see p. 358), the difference observed in the behaviour of Classes 3 and 4 towards the sera of those classes are very significant.

It seems evident that Classes 3 and 4 are sharply differentiated from one another, although the position assumed by "Y-Lister" and the behaviour of the Class 4 strains towards a serum to be considered in the next section indicates that these two classes of organism are much more nearly related to one another than either of them are to Classes 1 or 2.

(*d*) *Agglutination of the Mannite-fermenting Strains.*

Although with the mannite-fermenters, as was shown in the last section, the "absorption" of agglutinin reaction demonstrates the

degree of formation of the antibody-antigen complex more delicately than the simple agglutination reaction, the differences obtained in the final results of the two tests are so slight that it is not necessary to employ the more difficult and laborious "absorption" method. For this reason the remaining strains and sera were examined by agglutination only, using dilutions of serum (T. × 4, T. × 2, T. × 1·3 and T. × 1), which come within the range of *specific* agglutination.

Besides the results given in Tables XI, XII, XIII, XIV and XV, further results yielded by other sera and strains are shown in Tables XVI, XVII and XVIII. The sera and strains used are there tabulated with sufficient clearness to render it unnecessary to list them here; it is only necessary to state that none of the remaining strains showed any agglutination, in the dilutions used, with "Flexner Ledingham" (Class 4 serum). Thus there are no positive results to be shown with this serum other than those shown in Tables XIII and XV.

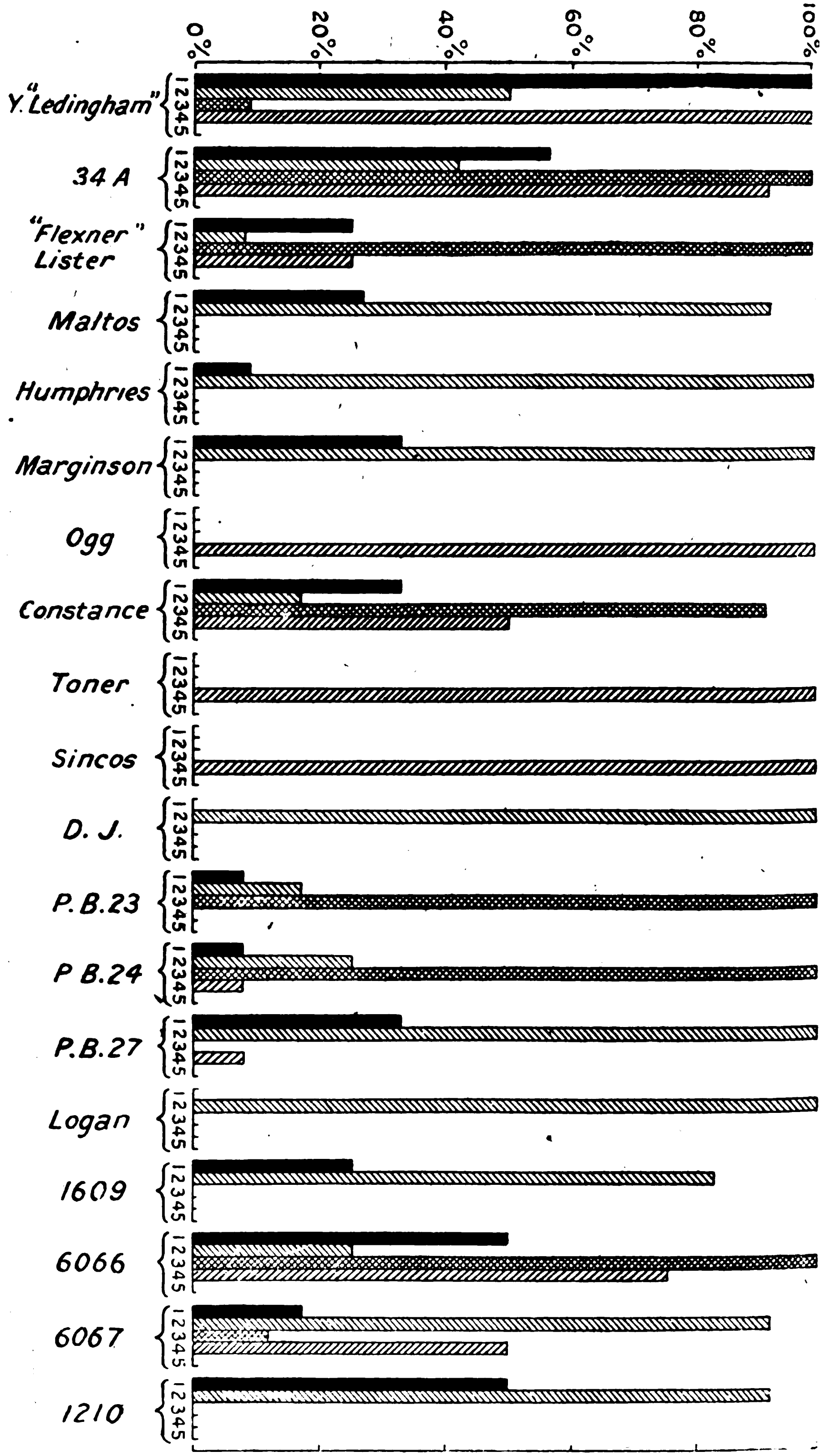
TABLE XVI.

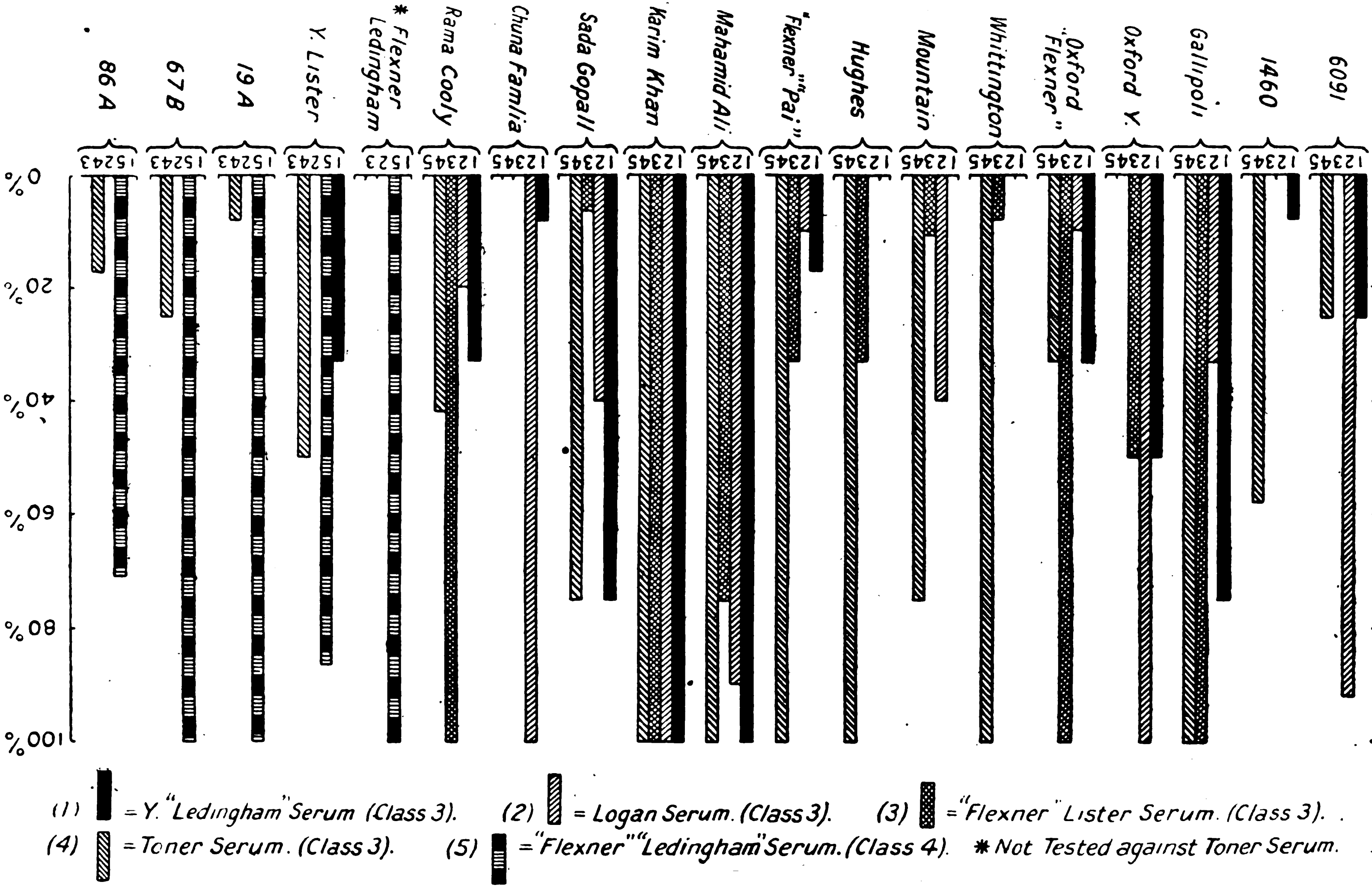
	Y Ledingham serum Titre 1 : 8000				Logan serum Titre 1 : 4000			
	1 : 2000 T. × 4	1 : 4000 T. × 2	1 : 6000 T. × 1·3	1 : 8000 T. × 1	1 : 1000 T. × 4	1 : 2000 T. × 2	1 : 3000 T. × 1·3	1 : 4000 T. × 1
Y Ledingham ..	+++	+++	+++	+++	..	..	..	..
Logan	..	..	..	..	+++	+++	+++	+
Oxford Flexner ..	+++	+	—	—	+	—	—	—
Oxford Y	+++	++	+	..	+++	+++	+++	+++
Hughes	—	—	—	—	—	—	—	—
Whittington ..	—	—	—	—	—	—	—	—
Mountain	—	—	—	—	+++	+	—	—
Flexner "Pai" ..	++	—	—	—	+	—	—	—
Mahamid Ali ..	+++	+++	+++	+++	+++	+++	++	+
Karim Khan ..	+++	+++	+++	+++	+++	+++	+++	++
Sada Gopall ..	+++	+++	+++	—	+++	+	—	—
Chuna Famlia ..	+	—	—	—	+++	+++	+++	+
Rama Cooly ..	+++	+	—	—	++	—	—	—

TABLE XVII.

Flexner Lister Serum (Titre 1 : 4000)

	1 : 1000 T. × 4	1 : 2000 T. × 2	1 : 3000 T. × 1·3	1 : 4000 T. × 1		1 : 1000 T. × 4	1 : 2000 T. × 2	1 : 3000 T. × 1·3	1 : 4000 T. × 1
Flexner Lister	+++	+++	+++	+++	..	..	..	..	..
Marginson ..	—	—	—	—	Gallipoli ..	+++	+++	+++	+++
D. J.	—	—	—	—	Oxford Flexner	+++	+++	+++	+++
P. B. 23 ..	+++	+++	+++	+++	Oxford Y ..	+++	++	+	—
P. B. 24 ..	+++	+++	+++	+++	Hughes ..	++	+	+	—
P. B. 27 ..	—	—	—	—	Whittington..	+	—	—	—
Logan	—	—	—	—	Mountain ..	++	—	—	—
1609	—	—	—	—	Flexner "Pai"	+++	+++	+++	+++
6066	+++	+++	+++	+++	Mahamid Ali	+++	+++	++	+
6067	++	—	—	—	Karim Khan..	+++	+++	+++	+++
1210	—	—	—	—	Sada Gopall ..	+	—	—	—
6091	—	—	—	—	Chuna Famlia	—	—	—	—
1460	—	—	—	—	Rama Cooly ..	+++	+++	+++	+++


0%
20%
40%
60%
80%
100%
"Y. Ledingham"
34 A
"Flexner" Lister
Maltos
Humphries
Marginson
Ogg
Constance
Toner
Sincos
D. J.
P. B. 23
P B. 24
P. B. 27
Logan
1609
6066
6067
1210



Showing the Percentage of Agglutination with each Strain against the above Sera.

FIG. 14.

Only one Class 3 strain ("Mahamid Ali") agglutinated in the lower dilutions of the Class 4 serum, and this showed a single plus in a dilution of T × 32.

In Table XIX the results shown in Tables XI, XII, XIV, XVI, XVII and XVIII are presented in the form of percentages by the method of counting the pluses. The percentages given in Tables XV and XIX are represented in fig. 14 in the form of columns which show the degree to which every strain agglutinates with each of the five sera, except "Flexner Ledingham" which was not tested against "Toner" serum.

TABLE XVIII.

Toner Serum (Titre 1 : 8000)

		1 : 2000 T. × 4	1 : 4000 T. × 2	1 : 6000 T. × 1·3	1 : 8000 T. × 1		1 : 2000 T. × 4	1 : 4000 T. + 2	1 : 6000 T. × 1·3	1 : 8000 T. × 1	
Class 3	Toner ..	+++	+++	+++	+++	Gallipoli	+++	+++	+++	+++	Class 3
	Sincos ..	+++	+++	+++	+++	Oxford Flexner	+++	+	—	—	
	Ogg ..	+++	+++	+++	+++	Flexner "Pai"	++	++	—	—	
	Mountain	+++	+++	++	+	Mahamid Ali	+++	+++	+++	+++	
	Whitting- ton	+++	+++	+++	+++	Karim Khan	+++	+++	+++	+++	
	Hughes ..	+++	+++	+++	+++	Sada Go- pall	+++	+++	+++	—	
	1460 ..	+++	++	++	—	Rama Cooly	+++	++	—	—	
	Y Leding- ham	+++	+++	+++	+++	Y Lister..	+++	+++	—	—	Class 4*
	34 A. ..	+++	+++	+++	++	19 A. ..	+	—	—	—	
	Flexner Lister	+++	—	—	—	67 B. ..	+++	—	—	—	
	Constance	+++	+++	—	—	86 A. ..	++	—	—	—	
	P. B. 24 ..	+	—	—	—						
	P. B. 27 ..	+	—	—	—						
	6066 ..	+++	+++	++	+						
	6067 ..	+++	+++	—	—						
	6091 ..	++	+	—	—						

The following strains gave negative results in the above dilutions: Maltos, Humphries, Marginson, D. J., P. B. 23, Logan, 1609, 1210, Oxford Y and Chuna Famlia.

* Flexner Ledingham was not tested with this serum.

In examining the figure it will be noticed :—

(1) That every one of the thirty-eight strains is agglutinated to a high degree by at least one serum.

(2) That the only strains which agglutinate at all with the Class 4 serum are the Class 4 strains themselves, all of which agglutinate to over seventy per cent with this serum.

(3) That, of the Class 3 strains, 42·4 per cent agglutinate with all four Class 3 sera ; 15·2 per cent agglutinate with only three Class 3 sera ; 27·2 per cent agglutinate with only two Class 3 sera ; 15·2 per cent agglutinate with only one Class 3 serum.

(4) That (*a*) "Y-Ledingham" serum agglutinates 75·8 per cent of Class 3 strains.

(*b*) "Logan" serum agglutinates 81·8 per cent of the Class 3 strains.

(*c*) "Flexner Lister" serum agglutinates 57·6 per cent of Class 3 strains.

(*d*) "Toner" serum agglutinates 69·5 per cent of Class 3 strains.

TABLE XIX.

Percentage of agglutination

		Y Ledingham serum	Logan serum	Flexner Lister serum	Toner serum
Class 3	Y Ledingham ..	100	50	9	100
	34 A.	56	42	100	92
	Flexner Lister ..	25	8	100	25
	Maltos	27	92	0	0
	Humphries	9	100	0	0
	Marginson	33	100	0	0
	Ogg	0	0	0	100
	Constance	33	17	91	50
	Toner	0	0	0	100
	Sincos	0	0	0	100
	D. J.	0	100	0	0
	P. B. 23	8	17	100	0
	P. B. 24	8	25	100	8
	P. B. 27	33	100	0	8
	Logan	0	100	0	0
	1609	25	83	0	0
	6066	50	25	100	75
	6067	17	92	11	50
	1210	50	92	0	0
	6091	25	92	0	25
	1460	8	0	0	58
	Gallipoli	75	33	100	100
	Oxford Y	50	100	50	0
	Oxford Flexner ..	33	10	100	33
	Whittington	0	0	6	100
	Mountain	0	40	11	75
	Hughes	0	0	33	100
	Flexner "Pai" ..	17	10	100	33
	Mahamid Ali ..	100	90	75	100
	Karim Khan.. ..	100	100	100	100
	Sada Gopall	75	40	6	75
	Chuna Famlia ..	8	100	0	0
	Rama Cooly	33	20	100	42
Class 4	Flexner Ledingham	0	0	0	*
	Y Lister	33	0	0	50
	19 A.	0	0	0	8
	67 B.	0	0	0	25
	86 A.	0	0	0	17

* Not tested.

The only positive results with Flexner Ledingham serum are shown in Table XV.

(5) That the sera which agglutinate the five Class 3 strains, reacting only with one serum, are equally active in sensitizing strains which agglutinate to a high degree with other sera.

(6) That the Class 4 strains do agglutinate with some Class 3 sera

although the converse is not the case. (It will be remembered that "Y-Lister" absorbed 100 per cent of agglutinins from "Y-Ledingham" serum.)

In view of the fact that the strain "Karim Khan" agglutinated to 100 per cent with all four of the Class 3 sera, a serum was prepared against this strain with a titre of 1 in 4,000. It was hoped that as this strain possesses antigenic properties allowing it to be sensitized to the full power of the four sera which agglutinate all Class 3 strains, it would also possess agglutinogenic properties enabling it to produce a serum which would agglutinate all the Class 3 strains. All the strains of Classes 3 and 4 were tested against this serum, and only the strains shown in Table XX agglutinated. All the remainder gave a negative result. The agglutination of strains by this serum is apparently not dependent upon the strain being agglutinable by any other serum.

TABLE XX.

Karim Khan Serum (Titre 1 : 4000)

	1 : 1000 T. × 4	1 : 2000 T. × 2	1 : 3000 T. × 1·3	1 : 4000 T. × 1	Percentage of agglutination
Karim Khan..	+++	+++	+++	+++	100
Y "Ledingham"	++	—	—	—	17
34 A.	+++	+++	++	—	67
Flexner Lister	+++	—	—	—	25
Constance	+++	+++	+++	—	75
P. B. 23	++	—	—	—	17
P. B. 24	+++	—	—	—	25
6066	+++	—	—	—	25
Gallipoli	+++	+++	+++	+++	100
Oxford Y	+++	—	—	—	25
Oxford "Flexner"	+++	+++	+	—	58
"Flexner" "Pai"	+++	+++	+	—	58
Mahamid Ali..	+++	+++	+++	+++	100
Sada Gopall	+	—	—	—	8
Rama Cooly	+++	+	—	—	33

It may be well to recall here that, in low dilutions such as T. × 16, all the Class 3 strains which were tested were agglutinated by any Class 3 serum.

From the evidence of these experiments it would seem that the thirty-eight strains of mannite-fermenters fall into two sub-groups which are accurately defined serologically, and by the action of the various strains on lactose; these coincide with the division of the group into Classes 3 and 4.

Class 3 comprises strains which might be described as "Flexner" "Y," "D'Herelle," the "para-Flexner" of Lancelin and Rideau, "many of Ohno's strains 'G to L' and Shiga's groups 2, 3 and 4," and though it is not possible to correlate any indvidual strain with Kruse's

classification, it is probable that his groups A, B, C, and D are represented, etc.

Even the names of the strains (p. 267) indicate that these bacilli are of different fermentative types. Nevertheless, there is no equivalent grouping by specific sera.

I consider the strains grouped together in Class 3 to belong to the same species, and only to vary among themselves in a minor degree as to their agglutinability and agglutinogenic properties, and probably also in their antigenic activities. It may be that there exists an infinite variety of "patterns" for what Nicolle describes as a "mosaic of antigens." Such a supposition would explain the results shown in fig. 14. Further, it would seem that the agglutinability of the organism is not dependent upon the same factors which determine its agglutinogenic powers, e.g., compare the strains "Y-Ledingham," "Logan," "Flexner Lister," and "Toner" in fig. 14, and "Karim Khan" in Table XX.

Classes 3 and 4, although quite distinct from one another, are nevertheless nearly related, as is evidenced by the fact that Class 4 strains agglutinate quite markedly with some Class 3 sera within the zone of "specific" agglutination.

Class 4 is certainly equivalent to Kruse E, which both Kruse and Hutt consider to be a "chief race," i.e., capable *per se* of causing dysentery. Berthlein was able to isolate only strains belonging to this class in the cases he examined in the epidemic reported on by him. The strains comprising Class 4 (Kruse E) would fall into the group comprised by Andrewes' *B. dispar*. Here again we have evidence that Michaelis's "acid agglutination" is not of much service in determining whether or not a strain belongs to the pathogenic dysentery group.

The three Mesopotamian strains belonging to Class 4 were isolated from acute cases of dysentery.

From the evidence produced above, I am bound to agree with Fraser in his conclusion that "Flexner," "Y," etc., are not types.

Hehewerth advised polyvalent sera for the agglutination test for identifying mannite-fermenters, and I think his advice quite justifiable.

I am of opinion that it is necessary to prepare sera against a few carefully-selected strains and to pool these, in order to produce a diagnostic agglutinating serum which will agglutinate all the varieties of organisms included in Class 3 as defined in Table I of this paper.[1] I would go even further and suggest that the therapeutic serum should be made on the same lines, in the belief that were this done there would be fewer conflicting reports from various authors concerning the treatment of the "Flexner-Y" type of bacillary dysentery by specific serum.

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[1] Such a serum has been prepared, and the reports received concerning it are eminently satisfactory.

(*e*) *Superimposed Agglutinogenic Tests.*

Further data which might serve for the classification of dysentery bacilli was afforded by experiments under this heading. It is of interest to recall that:—

Gordon showed for the meningococcus that, by superimposing antigen of a specifically distinct type on the blood of a rabbit already elaborating agglutinins in response to the stimulus of another type the agglutinins formed for the first organism underwent their normal decline and new agglutinins, specific for the second type, made their appearance in the blood. If, however, the two strains used for the experiment were only variants of the same type of antigen the result of injecting the second strain was to increase the production of the agglutinins already being elaborated.

These experiments which, in Gordon's hands, gave such clear-cut results with the four types of meningococcus, are found to afford equally satisfactory evidence when applied to dysentery bacilli.

The emulsions used throughout these experiments were made by washing off an eighteen-hour agar culture with 0·5 per cent phenol in saline and standardizing it to 1,000 millions per cubic centimetre by the method of counting in a 0·02 counting cell with dark-ground illumination. The tubes were then sealed off and incubated for six hours at 37° C. to kill the bacilli.

Six rabbits (of 1,250 grammes weight) each received intravenously 500 million bacilli of the "Logan" strain (Class 3). On the fifth day[1] from this first dose they were treated as follows:—

Rabbit A was not further interfered with.

Rabbit B[2] received a further dose of 500×10^6 "Logan" strain (Class 3).

Rabbit C received 500×10^6 of "Dean I" strain (Class 1).

Rabbit D received 500×10^6 of "Flexner Lister" strain (Class 3).

Rabbit E received 500×10^6 of "Y-Ledingham" strain (Class 3).

Rabbit F received 500×10^6 of "Flexner Ledingham" strain (Class 4).

A sample of blood was taken from each rabbit before the primary inoculation and on each of the eleven days following this, and the serum tested against "Logan" and the strain with which they were subsequently to be inoculated.

---

[1] This time interval, indicated by previous experience, was chosen because it allows of a decline in the agglutinins produced by the first dose before the stimulus of the second dose takes effect.

[2] This rabbit belonged to a breed which experience has shown to be bad as regards agglutinin production, but was used owing to shortage of animals. It was chosen to represent this control as being of least importance.

TABLE XXI.

			Before inoculation	1st day	2nd day	3rd day	4th day	5th day	6th day	7th day	8th day	9th day	10th day	11th day
Rabbit A (fig. 15)	Titre of serum	v. "Logan"	− 25	− 25	− 25	+200	+2,000	+12,000	+20,000	+ 6,000	+ 5,000	+ 4,000	+ 4,000	+ 4,000
Rabbit B (fig. 16)	Titre of serum	v. "Logan"	− 25	− 25	− 25	− 25	+ 50	+ 600	+ 1,000	+ 500	+ 600	+ 2,000	+ 8,000	+14,000
		v. Logan												
Rabbit C (fig. 17)	Titre of serum	v. "Logan"	− 20	+ 20	+ 40	+240	+2,500	+ 5.000	+ 7.000	+ 5,000	+ 4,500	+ 3,500	+ 3,500	+ 3,000
		v. "Dean" I	− 20	− 20	+ 20	+ 40	+ 40	+ 60	+ 80	+ 100	+ 1,000	+ 3,000	+ 4,000	+ 4,500
Rabbit D (fig. 18)	Titre of serum	v. "Logan"	− 25	− 25	+ 25	+400	+4,000	+10.000	+12.000	+ 8.000	+16,000	+16.000	+24,000	+24,000
		v. "Flexner" Lister ..	+ 25	+ 25	+ 25	+100	+ 500	+ 500	+ 1,000	+ 1,000	+ 2,000	+ 2.000	+ 4,000	+ 6,000
Rabbit E (fig. 19)	Titre of serum	v. "Logan"	+ 25	+ 25	+ 50	+400	+3,000	+12,000	+24,000	+16,000	+10,000	+12,000	+10,000	+10,000
		v. "Y-Ledingham" ..	+ 50	+ 50	+100	+300	+2,000	+ 8,000	+10,000	+ 8,000	+ 8,000	+14,000	+16,000	+16,000
Rabbit F (fig. 20)	Titre of serum	v. "Logan"	− 25	− 25	− 25	+300	+5,000	+ 5.000	+ 8.000	+ 4,000	+ 3.000	+ 3.000	+ 2,000	+ 2,000
		v. "Flexner Ledingham"	+ 25	+ 25	+ 50	+ 50	+ 500	+ 600	+ 600	+ 1,000	+ 2,000	+ 5 000	+ 8,000	+10,000

The results of these titrations are shown in Table XXI, and are charted in graphic form in figs. 15, 16, 17, 18, 19 and 20.

In examining these figs. and the table it will be seen :—

(1) That there is a "lag" of two or three days from the date of inoculation before the production of an appreciable amount of agglutinin.

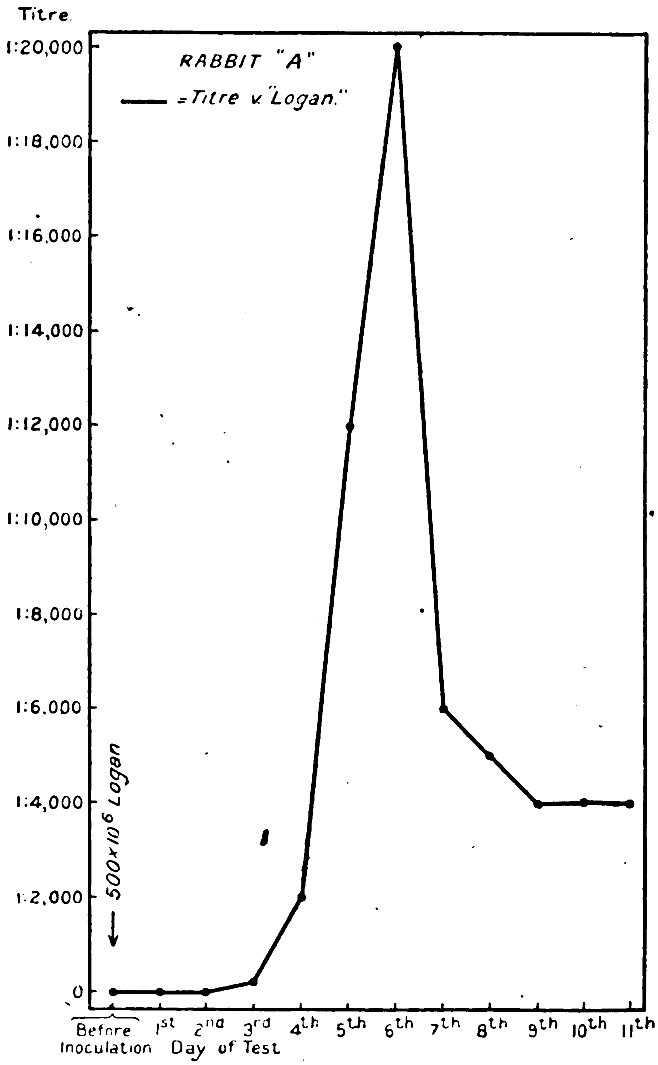

FIG. 15.

(2) That the agglutinins produced by Rabbit A (as the result of a single dose of "Logan"), after the recognized "lag" period, rise rapidly and reach their maximum on the sixth day; they then fall rapidly and find

a steady level about the ninth day. The general form of the curve and the period of rise and fall are confirmed by the other rabbits.

(3) That the agglutinin curve of Rabbit B, in conformity with that of A is falling on the seventh day, i.e., within the "lag" period following the second dose of "Logan"; after which, at the expected time, the agglutinins rise rapidly. This shows the effect of a superimposed dose of the same antigen as was given for the first dose (see footnote, p. 388).

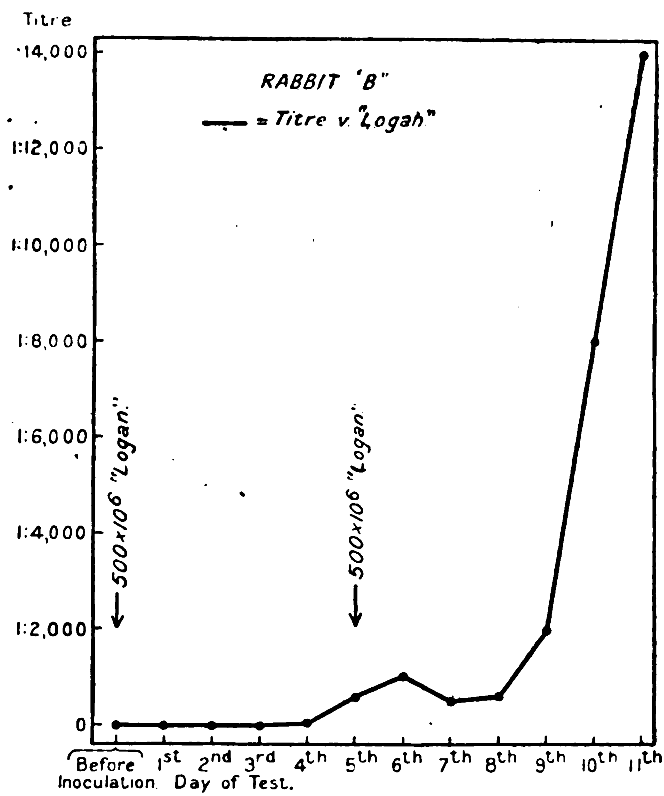

FIG. 16.

(4) That the curve for Rabbit C again shows the primary "lag," after which the agglutinin for the primary antigen "Logan" rises rapidly to reach its maximum on the sixth day and then again falls rapidly. This agrees with the curve produced by rabbit A. After the "lag" period of the dose of secondary antigen (Dean I), the curve for the primary antigen continues to fall, whereas the curve for the secondary antigen rises rapidly. Obviously, these two antigens are specifically quite distinct. The group agglutinins produced are only to be detected in dilutions of T. × 50 to T. × 80.

(5) That in the curves for Rabbit D, on the termination of the primary "lag" the agglutinins for the primary antigen ("Logan") rise and reach their maximum on the sixth day; falling during the secondary "lag" period, they again rise rapidly. Meanwhile the agglutinin for the secondary antigen ("Flexner Lister") has risen slightly in consequence of the dose of primary antigen, and, after the secondary "lag" period, begins its rapid rise. Here the two antigens are certainly of the same type, and the curves agree with those produced by Rabbit B.

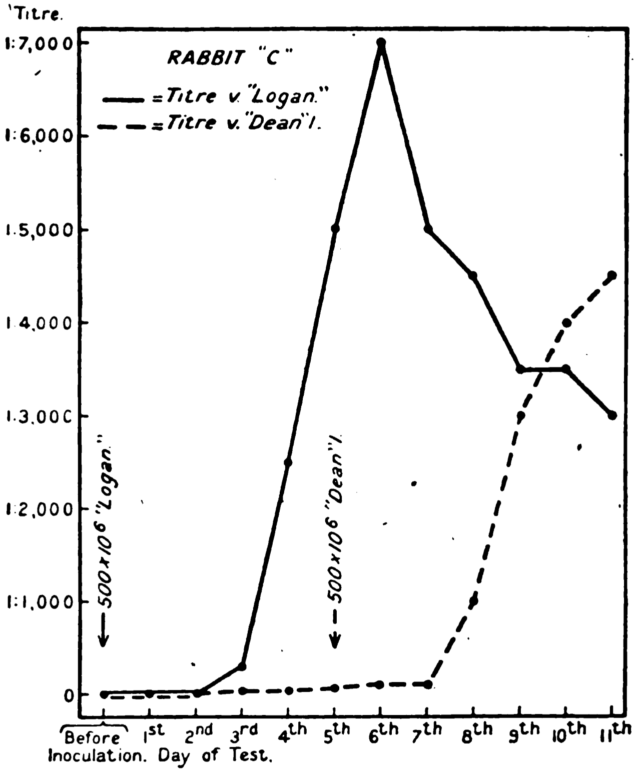

FIG. 17.

(6) That the same might be said for the curves produced by Rabbit E as was said for those of Rabbit D. Here, however, instead of the agglutinins for the primary antigen (Logan) rising after the secondary "lag" period they have remained stationary, while the agglutinin curve for the secondary antigen (Y-Ledingham) has risen rapidly.

The explanation of this is suggested by the behaviour of these two strains as shown in fig. 14, where, it will have been noticed, that although "Logan" serum agglutinates "Y-Ledingham" strain, the converse is not the case. Nevertheless the curves in this instance are in agreement with

those of the Rabbits B and D, and therefore the two antigens are of the same type.

(7) That the agglutinin curves for Rabbit F are of the same type as those produced by Rabbit C, but in this case the primary antigen

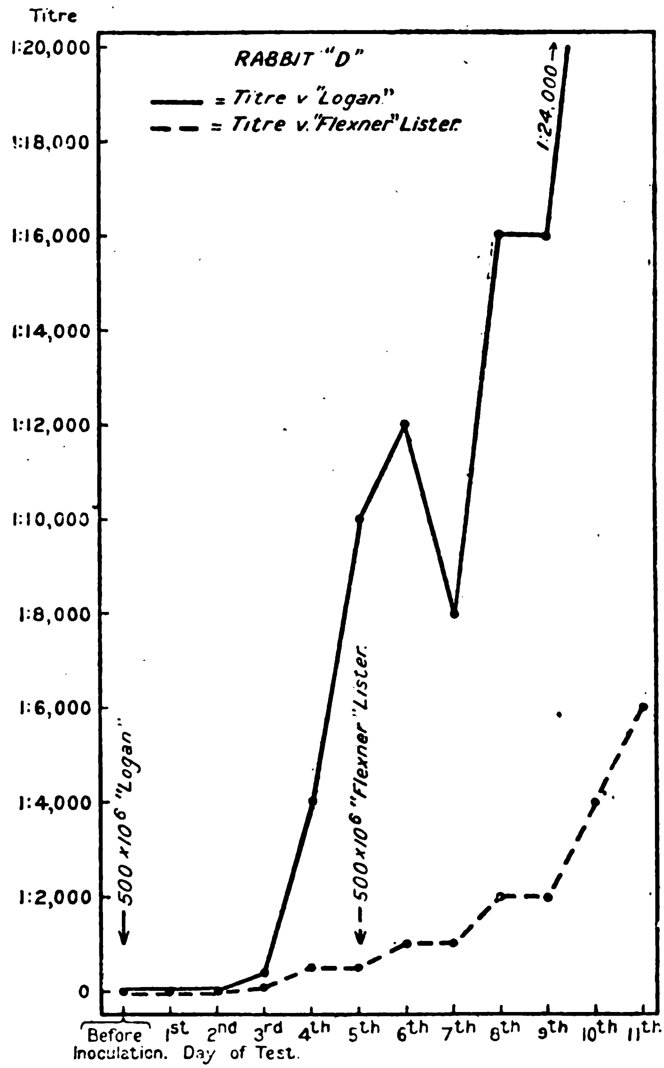

FIG. 18.

("Logan") stimulates a slightly greater production of "group" agglutinins against the secondary antigen ("Flexner Ledingham") which are only detected in dilutions T. × 10, T. × 13, etc. Thus it would seem that the two antigens used in this experiment are specifically distinct.

Besides the experiments already considered one other of this nature was performed.

Rabbit C was allowed to rest for twenty days in order that the agglutinins for the primary antigen ("Logan") and the secondary

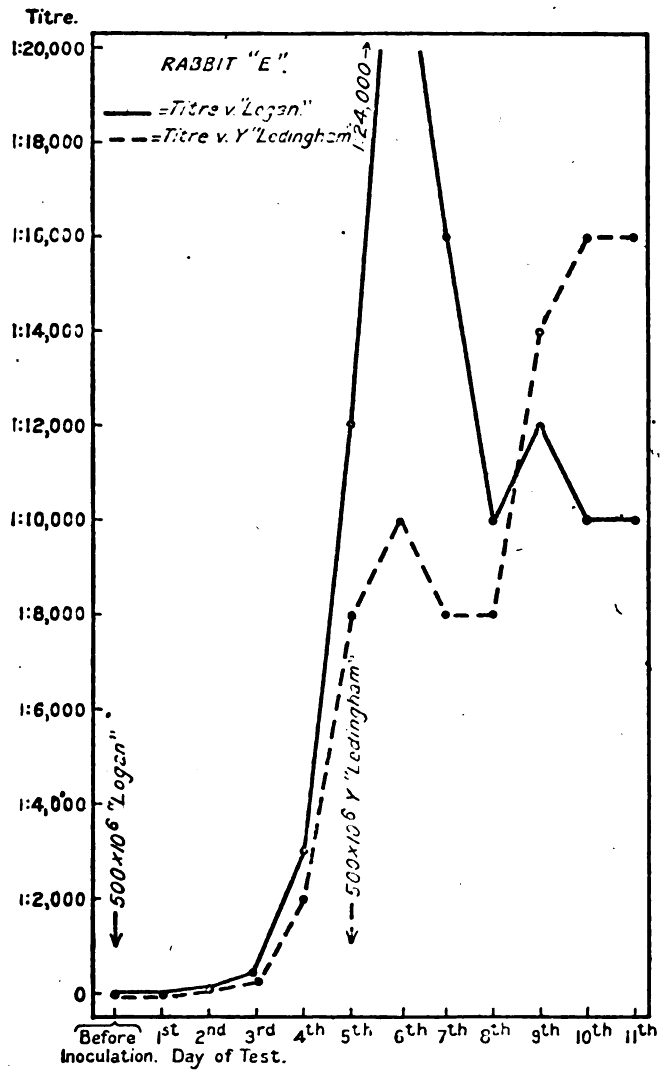

FIG. 19.

antigen ("Dean I") might reach constant levels. When this had occurred the rabbit received a dose of strain 13 (Class 2) intravenously. The emulsion was prepared in the same way as the previous ones. The agglutinins for the primary and secondary antigens remained absolutely stationary throughout the five days during which they were tested, whereas,

after a "lag" period of three days, agglutinins for the tertiary antigen (strain 13) appeared. This gives a repitition of the curves previously given by Rabbit A and also by Rabbit F.

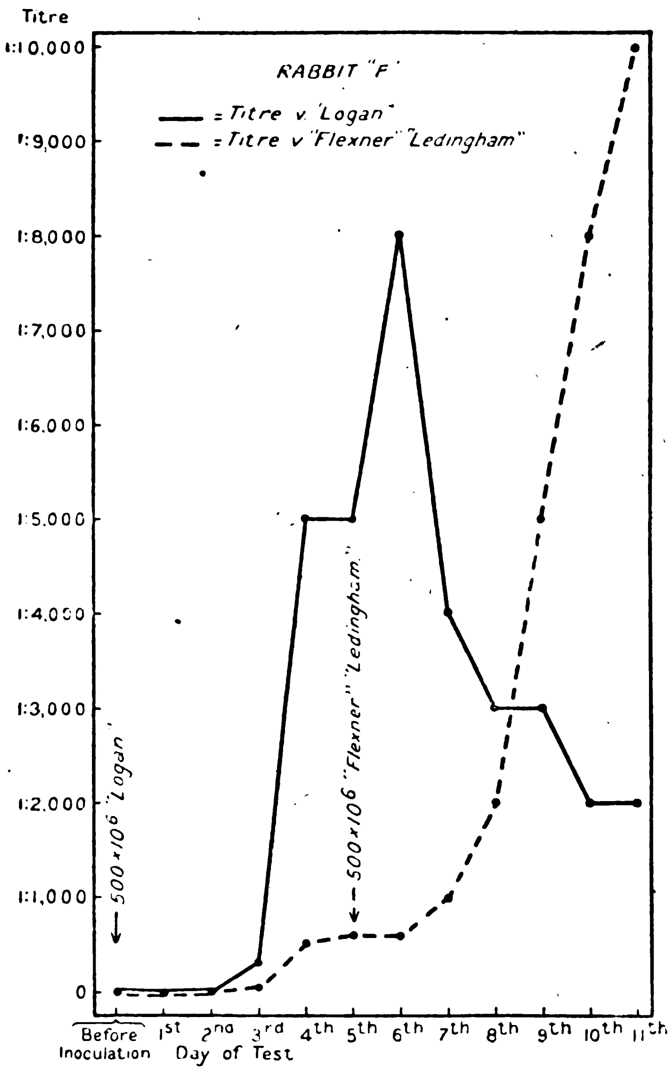

FIG. 20.

From these experiments, as far as they go, it is fair to conclude that the Class 1, 2, 3 and 4 antigens are specifically distinct from one another, and that the three strains chosen to represent Class 3 are of the same species although selected as possessing different agglutinating and agglutinogenic properties.

Conclusions.

In as far as the dysentery group of bacilli are represented by the fifty-three strains under examination in this paper, it seems clear :—

(1) That Classes 1, 2, 3 and 4 are generically related and that all should be called *Bacillus dysenteriæ*.

(2) That *B. dysenteriæ* "Shiga-Kruse" (Class 1) forms a well-defined homogeneous species, distinct from Classes 2, 3 and 4.[1]

(3) That *B. dysenteriæ* "Schmitz" (Class 2) is a clearly defined and homogeneous species differing from Classes 1, 3 and 4; that this species appears to be identical with "Andrewes'" *B. ambiguus.*[1]

(4) That the fermentation of "sugars" does not afford sufficient evidence whereby the mannite-fermenters can be specifically defined, as it is not in accord with serological findings.

(5) That the mannite-fermenters comprised by Class 3 ("Flexner," "Y," etc.) form one species sharply differentiated from Classes 1 and 2, but more nearly related to Class 4.

That there is no evidence of a sharp division of the class into types, as there is every intermediate degree ranging between a complete reaction and a negative reaction with a given Class 3 serum. The evidence afforded by the superimposed agglutinogenic experiments supports this conclusion.

It is probable that a certain agglutinating antigen predominates in a given strain.

(6) That the agglutinogenic properties and agglutinability of the strains comprising Class 3 are, to some degree, at variance with one another necessitating sera prepared against more than one carefully selected strain to sensitize all the strains.

(7) That Castellani's "absorption" reaction, when applied to Class 3 strains, although it is more sensitive in determining the degree of sensitization of the strains tested than is the simple agglutination test, affords no marked advantage over the latter test. That this in itself is strong presumptive evidence of the unity of species of this class.

(8) That *B. dysenteriæ* "Kruse E" (Class 4) is specifically distinct from Classes 1, 2 and 3, but exhibits a closer relationship to Class 3 than it does to Classes 1 and 2. That this bacillus is included in Andrewes' *B. dispar.*[1]

(9) That "group" agglutination may interfere with "specific" agglutination in quite high dilutions (T. × 4) of agglutinating serum, when the species are closely related as in the case of Classes 3 and 4, and to a much less extent when dealing with species differing as widely as Classes 1, 2 and 3.

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[1] Some preliminary experiments on the protection afforded to rabbits by vaccines against lethal doses of dysentery bacilli support these conclusions. Ruffer and Willmore showed that sera prepared against El Tor No. 1 and Kruse D failed to protect against lethal doses of "Shiga-Kruse."

(10) That agglutination with normal rabbit serum in the dysentery group is dependent upon some intrinsic property of the strain of bacillus, but it is not sufficiently marked to interfere with the agglutination reaction due to "active" immunization of the animal.

(11) That the presence or absence of the power of forming indol is of value in distinguishing Classes 1 and 2.

(12) That Michaelis's "acid agglutination" reaction is of no value in determining whether or not a given bacillus belongs to the dysentery group.

Finally, I am indebted to Lieut.-Colonel D. Harvey, C.M.G., R.A.M.C., Officer in Charge of the Vaccine Department, Royal Army Medical College, for permitting and encouraging me to devote myself to this investigation and giving me the benefit of his opinion founded upon a wide experience.

To Captain H. F. Bellamy, R.A.M.C., of the Vaccine Department, Royal Army Medical College, for placing his technical knowledge of the German language at my disposal and for general assistance in preparing the work for the press.

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NEUROSES AND PSYCHOSES OF WAR.[1]

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Army Medical Service, and Consulting Neurologist.

Under the terms of the lectureship, the Bradshaw lecturer is free to promote the interests of medicine by a discussion of any relevant subject. I have undertaken, therefore, to bring to notice a short account of the neuroses and psychoses of war, confining my remarks especially to the neuroses more directly attributable to the stress of active warfare and what has been popularly called "shell shock."

Without this limitation it would have been necessary to have begun with a description of the neuroses and psychoses which occur during the training of the recruit. This indeed might be a fruitful introduction to the subject, as the nervous and mental disabilities of this period are instructive in relation to those of active warfare.

During the early months of the war under the voluntary system of recruitment, neurasthenic symptoms were not uncommon in association with conflicts in the minds of conscientious men, who were torn between duty to their country and their personal feelings, opinions and habits.

Neuroses and Psychoses of Training.

In more recent times, under compulsory service, many men have entered the Army who are constitutionally and by upbringing and education unable to adjust their outlook to service conditions. In other words, the young soldier becomes neurasthenic owing to a failure of adaptation to a continued emotional cause and the struggle to bring about such adaptation (Déjérine). This failure may take the form of either a nervous or a mental disability.

In the neurasthenic type, the symptoms are those well known in the neurasthenia of civil life—fatiguability, digestive disturbances, vague myalgic pains and hypochondriacal feelings. This is a nervous reaction to camp life and is frequently accompanied by fears and dreads in anticipation of what may happen when the soldier proceeds on active service, such as death or serious incapacitating wounds. A large number of these men are constitutional neurasthenics and have suffered from a nervous condition previous to joining the Army [1].

Those who have had opportunities of working in the mental war hospitals know how frequently young soldiers, especially when below the

[1] The Bradshaw Lecture delivered before the Royal College of Physicians of London, on November 7, 1918.

normal standard of mental development, are prone to mental breakdown during the early months of training and how readily any latent morbid or abnormal trend may be brought quickly to the surface under the stress of camp life and military discipline. (Henderson) [2].

Psychoses of War.

Although a large number of recruits with definitely neuropathic or psychopathic tendencies may pass through the period of training successfully, there remains a liability to breakdown when the soldier finds himself under the stress and strain of active service. Here the emotional causes are obviously more potent and more continuous and the psychoses are the reactions to a situation which cannot be adequately met. Although the statistics from the mental war hospitals differ to some extent, one is struck by the numbers of mental defectives and of those with known psychopathic heredity or disposition admitted as patients. Approximately ten per cent. of the patients coming in to the mental war hospitals from overseas have had a previous attack of certified insanity.

A confusional psychosis is probably the most common type of mental reaction observed in soldiers coming from overseas. In many cases it is superimposed upon a foundation of feeblemindedness. In others it forms the basic reaction and is attributable to a cerebral commotion, shell shock or psychical wound, occurring in soldiers with a psychopathic inheritance. In both these types the prognosis is good, the duration of the confused state being relatively short and lasting from a few days to several weeks.

There is another variety in which a confusional psychosis is the early phase or the onset of an underlying and more deeply-rooted disorder, such as dementia precox. Eager [3] has recorded that amongst the large number of cases admitted to the Lord Derby War Hospital, 28 per cent. belonged to the manic-depressive group, 19 per cent. were classified as mental deficiency and delusional insanity respectively, and 8 per cent. as dementia precox.

Although the study of mental reactions attributable to stress of campaign is of great psychiatric interest [4], I do not propose to continue the subject further, but ask you to accompany me to a neurological centre in France where we shall have an opportunity of observing some types of cases illustrative of the neuroses of war.

Clinical Types of War Neuroses.

We would see amongst the patients men who had been sufferers from a war neurosis on previous occasions and who had been returned to duty.

We would see also young and inexperienced soldiers who had given way to fear or alarm at their first experience of bombardment. Some of them would show the acute symptoms of fear in dilatation of the pupils, staring eyes, rapid action of heart and sweating. Others would give the impression of having lost, at all events for the time, their self-respect and

self-confidence. A few of them exhibit rhythmical tremors, which had no doubt been involuntary and irrepressible at first, but which were now within the range of voluntary control and susceptible of relief by distraction, persuasion and encouragement.

There would also be patients suffering from fatigue and nervous exhaustion, requiring rest in order to restore them to duty. The symptoms complained of by these patients, in addition to a sense of weariness, consist of irritability and jumpiness, with difficulty in concentrating attention. Some would probably say that their sleep was disturbed by unpleasant dreams connected with their duties and that they had difficulty in falling off to sleep and might waken with a start. Others might complain of palpitation, giddiness, breathlessness and a feeling of oppression or anxiety in the region of the heart.

Our attention would be called to another class of case in which the symptoms are those of an anxiety neurosis. The patients are commonly young officers. A frequent history is that after he has been abroad for several weeks or months, the officer begins to sleep badly and loses appetite. Worry and anxiety follow on this, he loses confidence in himself and thinks that he is incapable of doing his duty adequately. He becomes shaky, unduly emotional and finds that his sleep is disturbed by nightmares referring to his experiences of trench warfare. Even the waking hours may be distressful from the acute recollection of these experiences intruding into his memory. Headache, mental depression and a fine tremor may accompany these symptoms, but the reflexes are normal, the tongue is clean, and the pulse of normal frequency. In the more exaggerated types, fears as to his sanity, as to his ability to "carry on," as to whether his comrades may think he is a coward, begin to obsess him. This condition may continue and the soldier persevere with his work, until a commotional shock, an upsetting experience or bad news from home precipitates an incapacitating disability and he is sent to hospital.

On our progress through the wards our attention would be called to a class of case presenting very definite objective signs, such as we are accustomed to see more commonly in the neurological hospitals at home. Probably the largest class would show speech defects, such as mutism, deaf-mutism, aphonia and stuttering. Others would present diverse types of tremor and tic-like movements. We would see various forms of paralysis—especially of the lower limbs—with disturbances of gait of the astasic-abasic type. We might see one or more cases of "bent back"—the campto-cormia of the French writers.

Examination would reveal the fact that these symptoms were of a functional or hysterical character, and many of the patients had been admitted to hospital in a state of stupor following a shell explosion or burial.

Stupor, Delirium and Amnesia.

The cases forming the next group are especially interesting, as they demonstrate what may be regarded as the most acute expression of

psychoneurotic symptoms, due to fear, horror and profound emotional or commotional causes. Stupor and delirium are the outstanding features, and of the two types, one is distinguished by torpor or cerebral inactivity, the other by what has been called "visionary" or "oneiric" delirium.

The symptoms of the stupor type are quite distinctive. In the more severe class of case the patient is entirely unconscious of his surroundings; he lies motionless in bed and makes no reply to questions; his eyes show no recognition of what is before them; all the usual tests applied with the object of arresting his attention fail to provoke a response. A close examination reveals in many cases some rigidity of the limbs of the catatonic type. The deep reflexes may be normal or exaggerated; the pupil light reflex may be impaired or lost; the plantar response may be flexor or abolished. Urine may be passed normally, or catheterization may be necessary for a day or two. Swallowing is effected usually without difficulty.

In milder cases stupor is less profound. The patients may carry out simple actions, but in a slow and hesitating way. They present a dazed or confused appearance, are startled easily and take little or no notice of what is going on around them.

In the other type the delirium is accompanied by gestures. One sees a case in which the man looks out from the bed-clothes as if peering over the parapet of a trench, stares wildly around him and then hides his head. Others would sit up in bed, start suddenly and give vent to some expression of fear or alarm. When approached they would shrink and hide under the bed.

The general impression derived from a study of these cases is that the man is living through some past experiences of a terrifying kind. When information has been obtained as to the onset of the symptoms it has been found to be connected with a psychical shock, such as the mutilation or burial of a comrade or friend from shell explosion.

The duration of the stupor varies. In some instances the intensity of the stupor may have passed away before admission to hospital. It lasts usually from a few hours to several days and may pass off suddenly or gradually. This symptom is found mainly in young soldiers.

With the disappearance of the stupor the soldier may find that he is mute, deaf, paralysed, or unable to walk without assistance, the subject of a tremor, or very commonly the victim of an anxiety condition in which intense headache, battle dreams, insomnia, vertigo, lack of mental concentration and fatigue are prominent symptoms. The memory for the stupor period and probably also for some days antecedent to it is obliterated. In the milder cases it is merely confused and uncertain. Cases may be found in which the memory of the whole life antecedent to the shock has been wiped out; and there are other cases in which the memory of the specific emotional episode which precipitated the stupor may be retained, though that of the subsequent days is abolished. The amnesia of cerebral

concussion is probably more profound than in the emotional cases and is of both retrograde and anterograde type. It is to this period of stupor and amnesia that the soldier applies the term "loss of consciousness" or "loss of memory."

The majority of the cases of stupor and delirium are examples of psychoneurotic mental states, attributable to fear and horror, but phenomena essentially identical to them may be found in men who have been exposed to a cerebral concussion or commotion.

Organic and Functional Conditions.

At all times there may be a difficulty in the differential diagnosis of the concussion from the so-called emotional cases, but such diagnosis is more easily effected the earlier the patient is brought under observation. A careful neurological examination of men who have been exposed to the effects of shell or mine explosion or who have been buried and are suffering from loss of consciousness, stupor, mental confusion, delirium or paralysis, would in some instances reveal the physical signs of minor structural lesions of the brain or spinal cord.

In the writings of the earlier observers on this subject, and in many at the present time, there is a tendency to attribute many of the phenomena of shell shock and the war neuroses to physical causes, such as concussion, fatigue, or gas poisoning, and perhaps to ignore, or at all events under-estimate, the influence of the psychical factor. A school of the French neurologists in particular has laid stress upon the importance of "cerebral commotion" in the causation of the psychoneuroses of war.

The modern school of psycho-pathologists, on the other hand, may incline too much in the contrary direction and claim all the symptoms of the war neuroses to be of psycho-genetic origin. This school maintains that the neuroses of war arise from an inability on the part of the soldier to react to his environment; in other words, they are brought about by a failure of psychological adaptation and to the repression of one of the conflicting emotions which arise therefrom.

We may now proceed to examine in fuller detail the origin of the neuroses of war; and, in particular, their relation to the sudden incapacitating agency of "shell shock."

Concussion Shock.

The immediate clinical effect upon the soldier of cerebral concussion or commotion due to the forces generated by the explosion of shell or mine is a loss of consciousness which may last from a few minutes to several days. This may give place to a partial loss or "twilight state" of consciousness with which may be associated mental confusion or a "visionary" delirium resembling that which has been described.

A detailed neurological examination therefore is necessary in quite the

earliest states of all cases in order to determine the existence or otherwise of structural changes in the central nervous system.

We are indebted more especially to the French neurologists [5] working in the neurological centres of the French armies for observations on this point. The following have been observed in the earliest stages of shock: muscular relaxation and hypotonia, impairment or abolition of the deep reflexes, the presence of an extensor plantar response, retention of urine, inequality of the pupils, and impairment of the light reflex, hæmorrhages into or rupture of the retina and voltaic vertigo. The examination of the cerebrospinal fluid during the first two or three days following the shock may exhibit blood staining, raised pressure, increase of the albumin content and sometimes a lymphocytosis.

These objective signs may be quite transitory and disappear rapidly within a few days, so that when the patient is re-examined after a short interval no evidence of their existence is detected; but the presence of other symptoms may be observed. It is most unlikely that concussion, pure and simple, unaccompanied by any emotional element, gives rise to psychoneurotic symptoms. There is, however, a class of case in which early organic symptoms may be succeeded by those of an hysterical character.

Traumatic Neurosis.

It would appear, therefore, as if minor recoverable changes of a structural character due to "concussion" may play an indirect part through suggestion and association in the pathogenesis of those symptoms, which disappear under persuasion. This leads to the subject of "Traumatic Neurosis." A conception more in harmony with current psychological doctrine attributes the symptoms of the neurosis to psychical causes. Farrar [6] has thus expressed it: "The injury of nervous tissue is not necessarily the cause of any possible manifestations which may follow, but it may serve as the starting point of certain trains of association which need never be fully in the consciousness of the patient, but which nevertheless eventuate in the developed fixed neurosis, with all its psychical, neurological and somatic phenomena."

The chronic symptoms of the fixed neurosis, or sequeli of concussion, are, on the neurological side, persistent and often severe headache, photophobia, hyperasthesia to sounds, vertigo associated with labyrinthine hyperasthesia, insomnia and battle dreams. On the psychological side, loss or perversion of memory, irritability, loss of self-confidence, defective concentration and slowness of thought, over emotivity, depression, anxiety and even melancholia. Amongst these symptoms are several which are more characteristic of the anxiety neurosis, such as over-emotivity, "terror dreams," anxiety and depression. It is unlikely that concussion gives rise to anxiety unless this neurosis was in process of development at the time of the shock. Concussion, therefore, happening to soldiers in whom

neurotic symptoms are already present, may cause a sudden accentuation of the anxiety picture.

Although the symptoms mentioned may scarcely be regarded as peculiar to cerebral concussion in the orthodox sense, they are characteristic of quite a numerous class of patient in the War Hospitals at home. The course of this disability is always protracted and improvement may not take place until after many months. From the purely military standpoint the class is important as a relapse almost invariably follows a return to active service. Moreover, it is always a difficult matter to determine just the point where the neurosis merges into a subconscious or partially conscious exaggeration of symptoms. So many influences combine to favour exaggeration or prolongation of symptoms in soldiers, such as return to further service, permanent incapacity and considerations over pension, that there is no question in the whole range of psychoneurotic disorders upon which medical officers have greater difficulty in giving a decision. But malingering in the sense of being a conscious and reasoned simulation or creation of a pathological picture for the purpose of deceit is rare in our military neurological hospitals.

Failure of Psychological Adaptation.

Contemporary psycho-pathologists maintain that all neuroses are "reactive" disorders, that is to say, they are the consequences of a failure of psychological adaptation or readjustment to environment. Associated with the process of readjustment is repression, which, as Rivers [7] says is not in itself harmful, but only under conditions in which it fails to adapt the individual to his surroundings.

The psychological history of every individual will reveal how far he has been able to adapt his mental outlook to the ordinary and accidental circumstances of his life.

On entering the Army, as we have seen, men may break down owing to a failure to react normally and to readjust themselves to the conditions of military service, discipline, and training.

On entering the zone of the active operations of war, circumstances calling for adaptation and readjustment at once present themselves, and it is remarkable how large is the number of men who are able within a very short time to react physiologically, and maintain their nervous health for long periods under the exacting conditions which characterize modern warfare. It is not easy for various reasons to estimate the number of men admitted to hospital on account of war neuroses and the effects of shell shock, but an approximate estimate puts the number at from five to six per cent of the total sick transferred to the hospitals at home.

It is well known that soldiers wounded physically do not, as a rule, suffer from shell shock, although no doubt they have been exposed to the effects of shell or mine explosion just as have the unwounded. Wiltshire [8] explains the immunity of the wounded on the ground that

a physical wound neutralizes the action of the psychical causes of shell shock, but it is more likely that the somatic wound, being the ideal form of relief, is to the soldier the fulfilment of his wish to get away from an intolerable situation. Both anxiety and hysterical symptoms may appear later on, when the wound is healed. In all warfare, but especially in the trench form, which has been a special feature in the present war, numerous factors are at work to impair the soldiers' resistance.

PRODROMATA OF "SHELL SHOCK."

MacCurdy [9], who has written an instructive paper on the "War Neuroses," gives a graphic account of the development of the anxiety states, which are amongst the commonest of the War Neuroses. This writer has referred in detail to the mental conflict in soldiers on active service, and officers in particular, between desire to continue on duty and the repression of an increasing feeling of incapacity and apprehension. The soldier becomes fatigued, and his adaptation becomes weakened and finally lost. He feels every day more acutely sensitive of the horrors around him. He becomes apprehensive, and his courage forced. He begins to feel ashamed that he may be regarded as a coward by his comrades. He grows mentally and nervously more unstable. He regards as a weakness the thought of going sick. He fears that he may not be able to hide his fear.

Under the influence of mental conflicts such as these the soldier may resort to reckless and daring deeds. He becomes hypersensitive, irritable, and jumpy, and his sleep may be disturbed by dreams connected with his duties. Eventually the idea develops of how he can escape from an unbearable situation, and sometimes with this the desire for death and thoughts of suicide.

When this degree of mental anxiety and depression has been reached, and in many cases long before, any shock will precipitate a breakdown. Amongst such shocks may be horrible sights, partial burial in consequence of shell or mine explosion, an unusually dangerous situation, a serious disappointment or bad news from home, but most common of all a cerebral concussion or commotion from shell explosion. The effect of one or other of these traumata, but especially the last, is the onset of a stupor, a delirium or an amnesic "fugue."

PSYCHOLOGICAL CONTENT OF STUPOR.

The acute or major symptoms of the war neuroses follow upon the shell explosion or other precipitating cause.

The onset of these symptoms occurs usually under two conditions. First, they are observed as the soldier recovers from a stupor or amnesia, of the onset and duration of which he has no recollection. In some cases, however, a brief interval may elapse between the shell explosion and the loss of consciousness, in which an emotion of intense fear or horror may be active.

Secondly, the symptoms may develop after an interval of variable duration from the shock during which the soldier may have attempted to "carry on," may have been found wandering behind the lines in a somnambulistic "fugue," or may have been able to find his way back, alone or assisted, to a regimental dressing station or ambulance. In this last event the memory of what has occurred is retained, although the mental perspective may be blurred, and the man may state that he "fainted" or was momentarily stunned at the time of the shock. These patients may be able to describe the circumstances of the shell explosion, or give a vivid account of the horrible sights which they had seen.

As already described, the shell shock is the coping stone or precipitating agent in a series of mental preoccupations, which may have troubled the soldier for weeks and months. It will be of interest therefore to analyse, so far as this is possible, just what is the psychological content of the stupor as the effect of it upon the soldier's mind is such that he traces the development of his subsequent symptoms mainly to the "loss of consciousness," or "loss of memory," which he associates with the shock. In some cases, stupor-amnesia is of "dynamic" nature arising from a cerebral concussion or commotion. In other cases it is "functional" and of purely psychical character, but it is not unlikely that the latter may emerge from an original transient commotional loss of consciousness.

W. Brown [10], who was for some months in medical charge of a neurological centre in France, says that an examination of many of these cases under hypnosis shows that there is a dissociation or splitting of the personality rather than a true loss of consciousness. The patient is found to have a vague knowledge of his surroundings and is able to give some description of them. His attention, however, is mainly engaged in contemplating his subjective mental state, in which he is re-experiencing, as in a dream, the terrifying events of the firing line. He is of opinion that the stupor-amnesic phase corresponds to a period of subconscious emotional development, dominated by fear and not to the working merely of suggestion. Acting on this hypothesis, he has treated his patients by means of light hypnosis during which they go through their trench experiences; and in this way "work off" the suppressed emotion. It is this which, in his opinion, brings about the return of the power of speech and not direct suggestion.

Myers [11], who also has had favourable opportunities of studying cases of shell shock in the stupor phase, states that under hypnosis these men often become excited and not infrequently show clear evidence of living again through scenes which come vividly to their minds. He holds that the functional disorders of speech observed in stupor are the result of an inhibition which is usually traceable to intense fear or horror. In his view dissociation arising from inhibition is the fundamental cause of the effects of shell shock.

Mutism and Astasia Abasia.

It has been mentioned already that certain objective functional symptoms may be observed as the soldier emerges from the stupor, which follows a shell concussion or psychical shock. Of these the most important are mutism, deaf-mutism and the minor speech defects—aphonia and stuttering. Indeed, during the period of stupor, mutism and deaf-mutism are prominent symptoms and are attributable to the inhibiting influence of the fear or horror which underlies the stupor. It is, therefore, not surprising that mutism is the most common of the paralytic effects of shell shock, which are observed when the stupor passes away.

Mutism is accompanied frequently in the earlier stages by other symptoms of the neurosis such as headache, tremors, twitchings of the limbs and insomnia; and apparently as a kind of counterpoise to the dumbness, a certain fluency of expression in writing is not uncommon.

Another but less common motor disability resulting directly or indirectly from the effects of shell shock is astasia abasia, in which, on attempt at walking, the limbs are incapable of action, in spite of obvious effort to move them. It is observed in many atypical forms, some of which resemble the disordered gait accompanying organic disorders of the nervous system.

A variety of this disability is accompanied by anxiety, in which the patient is obsessed by a fear that he is unable to walk.

These disabilities of speech and gait if left untreated in the early stages may become "habits" and join the other functional disorders described under hysteria, as unconsciously developed "defence mechanisms."

Anxiety and Depression Symptoms.

The anxiety neurosis and anxiety depression are amongst the most common symptoms of the war neuroses. They may occur alone or in association with mutism and paralytic symptoms. We have already seen the development of an anxiety neurosis prior to the receipt of the psychical shock, or cerebral commotion.

The outstanding symptom of the anxiety neurosis is the recurrence of terrifying nightmares or "terror dreams" which torture the patient during sleep, and in consequence add to his troubles a fear of going to sleep.

Mott [12], who has made a study of the dreams, says that, although the soldier sometimes may have no conscious recollection of the dream, he may wake up suddenly in terror, bathed in perspiration, or he may have been heard to shout in his sleep and seem to go through a pantomime of fighting with bombs, rifle and bayonet. He concludes that fear and terror have left a deep impression on the minds of these men, and produced a continual state of fear emotivity.

The patient's progress towards recovery may be estimated largely by the degree and frequency of his dreams. The first sign of recovery from

the neurosis is when the dreams no longer wake the patient, although he may remember that he has had them. As the patient continues to improve the element of fear disappears from his waking life and in the course of time from the dreams (Core).

The prominent mental symptom of the anxiety neurosis is depression coloured by underlying fears and dreads. This depression is not continuous, nor is it of the negative type characteristic of the melancholic. It may be revealed outwardly by a drawn and anxious facial expression, and a lack of interest or of desire for companionship. There are periods when the patient is relatively free from anxiety, but such spells of intermission may be broken by apparently causeless waves of depression accompanied by anxiety and apprehension, and often associated with the intrusion into consciousness of the memory of a particular and unpleasant incident of war experience.

Rivers has pointed out that many of the most trying and distressing symptoms of war neuroses are not the direct result of the strain and shock of warfare, but are due to the attempts to banish from the mind distressing memories or painful affective states, which have come into being as the result of war experience. We find the patient repressing many anxieties, fears and mental preoccupations, bearing more or less directly on his career as a soldier.

Rows [13] has shown that of equal, and, perhaps, greater importance in the maintenance of the anxiety symptoms in soldiers, after the more acute or immediate symptoms of the war shock have passed away, are the memories of experiences in earlier life, with which a strong emotional tone is connected. These memories may be revived in dreams, which are often added to the war dreams, or they may be associated with delusions and hallucinations of hearing often of a persecutory type.

Cases such as those last mentioned, and they are not so uncommon as might be supposed, require prolonged mental analysis and much patience for their elucidation. If the patient can be brought to understand the nature of his trouble, to face it, and to recognize in it simply a memory of the past, the anxiety will lessen and eventually disappear.

An objective sign of the anxiety neurosis observed at the outset and subsequently is profound loss of body weight. This may occur, to a remarkable extent, up to as much as one or two stones. The recovery of the weight is coincident with the disappearance of anxiety and general improvement in the patient's health. Lowered blood-pressure and an unusual degree of fatigue on physical effort are associated phenomena.

A number of those who suffer from the milder forms of the anxiety neurosis, coming home from overseas, recover in a relatively short time, varying from a few weeks to three or four months, under conditions entailing rest, quiet and attention to sleep. About an equal number require special psychotherapeutic attention before they find relief from their more persistent symptoms. But if the mental disorder has become

fixed and systematized, the difficulties may be great, and recovery will not always take place.

Symptoms in Officers and Men.

It is a common observation that symptoms of anxiety and so-called neurasthenia are more common in officers, and that the more objective symptoms of hysteria—mutism, contractures, paralysis, astasia-abasia—are more frequently observed in men. In a general way this is true, but a combination of anxiety-depression and gross hysterical symptoms is by no means uncommon amongst men in the ranks.

Several explanations of this difference have been offered, but the most likely reason is found in the position of greater responsibility in which the officer is placed, and to the mental struggle which he undergoes in order to banish from his mind doubtings as to his adequacy or competency.

The statement has been made that the mental background of hysteria in the men is an attitude of antagonism to the fighting accompanied by an idea of release from an unbearable situation (McCurdy). This release may be obtained through several agencies, but a slight concussion, a psychical shock, partial burial, a minor and not necessarily incapacitating wound, an accident or an illness may be sufficient.

Hysteria in Soldiers.

The functional disorders of speech have been given separate mention, as mutism is due to dissociation arising from inhibition or subconscious emotional development during stupor. Interference with consciousness indeed appears to be the crucial test of so-called "shell shock."

It has been observed by all workers in the neurology of the war that hysterical manifestations are less frequent and less striking in the front lines. It is when the soldier is removed to calmer surroundings away from danger, such as a casualty clearing station, that the psycho-neurotic condition comes to light. If the patient is not treated suitably at this period, the emotion which causes the symptoms becomes fixed and more deeply rooted the older its inception. Hence hysterical paralyses, contractures, disorders of speech, of hearing, of gait and of vision, are more numerous in the base hospitals and especially in those at home.

Local injury, such as a minor gunshot wound when applied to any part of the body, may produce an hysterical disturbance in a predisposed person.

The onset of local pain also, with or without bruising of the part, may act as a determinant of a functional disorder. Following upon a fall or being thrown against some object in consequence of shell explosion or burial, but without any loss of consciousness, the soldier may complain of a severe pain in the back, which may be followed by loss of power in the legs of a functional character. In other cases the pain may interfere with extension of the spine. In order to relieve the pain an attitude of flexion of the body is assumed, and the condition known as "bent back" or camptocormia is

evolved. This is primarily an antalgic posture, which may eventually lead to a contracture of the muscles of the trunk of hysterical character.

Hysterical contractures of the hand, or foot, are frequently the outcome of a wound of the arm or leg with or without implication of the peripheral nerves of the limb. The exciting cause may be anything from a slight and superficial abrasion to a penetrating gunshot or shrapnel wound. Sometimes the contracture instantaneously follows the receipt of the wound, but in the majority of cases it would appear to be the outcome of suggestion following immobilization of the limb in a sling, splint or other mechanical apparatus.

It is not exceptional to find hysterical symptoms preceded by more or less vague pains in the joints of limbs which have been bruised. These pains may be the origin of hysterical paralyses or contractures, apparently of spontaneous origin, and which persist long after the pain has disappeared. Hysterical disorders, moreover, may develop while the soldier is in hospital suffering from a medical or surgical disability connected or not with war experience, such as trench feet or appendicitis.

Most of the war hysterias if allowed to become habitual are eventually "defence mechanisms" developed unconsciously, but persisting as reactions against various contingencies of which the chief is a desire not to return to the firing line, or indeed to any form of active warfare.

Any suggestion of organic disease on the part of the medical officer, on whose opinion the soldier rightly lays great stress, should be carefully avoided, as the latter is always ready to accept and retain in his mind any suggestion that he is not likely to recover.

Treatment of War Hysteria.

It is a matter of practical experience that the hysterical symptoms of the soldier can be cured rapidly and effectively by a well-directed convincing psychotherapy, consisting of suggestion, persuasion and re-education. On the contrary, their duration and persistence may be prolonged indefinitely by repeated changes from one hospital to another and by unsuitable and misguided methods, by which is meant a therapy promoted to suggest to the patient that he is suffering from a serious disability of organic nature, especially when this treatment is carried out in an atmosphere of sympathy and hero-worship. Treatment given at spas, where great attention is paid to electrotherapy, balneotherapy and massage, undoubtedly tends to fix the neurosis in the patient's consciousness.

It is universally admitted that the sooner soldier patients, suffering from any form of functional nervous disorder, are submitted to a therapy in accordance with the psychogenetic origin of their symptoms the more rapid and satisfactory is the cure.

Provision for Treatment of the Neuroses in the Army.

Early in 1915, in consequence of the large number of cases of this character requiring expert diagnosis and treatment, the Director-General

of the Army Medical Service established neurological sections in all the general Territorial Hospitals in the United Kingdom under the care and direction of physicians, who had special knowledge of, and experience in, diseases of the nervous system. A limited number of special hospitals was also set up for patients suffering from the more obviously psychical effects of shell shock and the war neuroses and who were not suitable for treatment in general hospitals [14].

As time went on a fuller knowledge and larger experience of these cases were acquired from a study of them in the special hospitals. It became evident that the multiform symptoms of the war neuroses and minor psychical disturbances following stress and strain of the campaign were of psychogenetic origin, and that a knowledge of normal and abnormal psychology and of mental disorders was essential in order to obtain correct insight into diagnosis and skill in treatment.

In consequence, a larger measure of success attended the treatment of those patients in special than in general hospitals, where the essential conditions of treatment were not available. Numbers of soldiers, therefore, were being discharged from the Service on account of functional nervous disorders of a kind curable under proper conditions of treatment. In order to remedy this state of affairs it was necessary largely to increase the number of special hospitals, to divert as far as this could be done the admission of functional cases from the general to the special hospitals, and to make provision for the training of special medical officers. Recommendations based on these principles were laid before the Director-General at a conference of neurologists and psychologists at the War Office in the autumn of 1917 and have now largely been carried into effect.

Training of Special Medical Officers.

In order to meet the needs of the special hospitals a training centre for medical officers was established in connexion with the Maghull Military Hospital under the direction of Lieutenant-Colonel Rows, who has done so much towards developing the psychological treatment of the war neuroses. In addition to acquiring a sound clinical knowledge of these disorders medical officers are grounded in the principles of psychology and psycho-pathology. I mention this especially as it is the first and at present the only school of clinical psycho-pathology in this country, although other training centres are being now established. It is the hope of those who are interested in this branch of medicine that so favourable an opportunity of continuing a school of this character should not be allowed to lapse, and that something should be done during the period of reconstruction after the war to establish on a permanent basis and for the benefit of civilian patients one or more institutions similar to that which has been founded to meet the urgent claims of the soldier.

Principles of Treatment of the War Neuroses.

There would appear to be general agreement upon the value of the segregation of soldiers suffering from the neuroses of war, and three to

four years' experience has justified the principle. It is essential that these patients, when segregated, should be under specially trained medical officers, and that "an atmosphere of cure" should pervade the special hospital. The great value of segregation is that all patients may be studied individually, and all agents determining causation, exaggeration or prolongation of symptoms may be sought out and eliminated. There is no evidence that in properly conducted hospitals these patients imitate each others' tremors or abnormal gaits, while it is well known that in general hospitals the eccentricities of conduct and behaviour of the hysterical patient make them objects of curiosity and often of humour to the other patients.

It has long been recognized that the sooner the patients are brought under skilled treatment the more rapid and satisfactory is the cure. The French Military Medical Service recognized this early in the war and established neurological centres in the zones of their armies. In consequence of the success attending the treatment of the war neuroses in these centres, similar centres were established in the areas of the British Armies in the winter of 1916-17.

A large number of cases of war neuroses in the early stages of their disability derive great benefit from a modified rest-cure. In the later or "habit" stages, a judicious combination of suitably directed psychotherapy and selected occupation according to the mental and physical fitness of the soldier, gives the most satisfactory results. Occupation, further, supplies the best means of grading the soldier when the time arrives for his discharge from hospital to duty.

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Clinical and other Notes.

TREATMENT OF PURULENT BRONCHITIS.

By Brevet-Colonel A. NAPIER.
Royal Army Medical Corps.

In October last the War Office circulated for general information a reprint of an article on "Purulent Bronchitis," by Drs. Abrahams, Hallows, Eyre, and French, which had appeared in the columns of the *Lancet*, of September 8, 1917. The article in question is particularly interesting to me, as it happens to deal with an ailment with which I have been for a good many years very familiar in my wards in the Victoria Infirmary, Glasgow. My object in writing this short note, however, is not simply to say this, but to indicate a line of treatment which I have found on the whole very successful in such cases, and I do this the more readily as the *Lancet* article is concerned almost entirely with bacteriology, and says comparatively little about treatment except in a general way: "Antiseptic Inhalation and Expectorant Mixture." The line of treatment I indicate will be best appreciated if I report a case which has recently been in my care.

Gunner R., R.G.A., aged 30; service one year eight months. This man, who has been for many years subject to very severe headaches and chronic bronchitis, was "gassed" (shell) on October 3, 1917. He was taken to hospital at Rouen on October 6, 1917, suffering from severe headache—throat and chest were also affected. On October 14, 1917, he was admitted into the 4th Scottish General Hospital, Stobhill, Glasgow. On October 16, 1917, it is noted: "Now much better, heart normal, no wheezing; urine ac., 1025, no albumin, no sugar, oxalates." On October 20, 1917, this man was so well that he was sent to an auxiliary hospital. On November 15, 1917, while still in the auxiliary hospital he was suddenly seized with acute pain in stomach and bowels, and temperature rose to 103° F.; he rapidly developed a severe headache, constant cough, loud wheezing and rapid respiration; lividity appeared early and continued until the end of the attack. Repeated and careful physical examination never at any time revealed any actual dulness to percussion, though at both bases the note was not so resonant as normally, and here also the R.M. was extremely feeble and filled both in inspiration and expiration with fine râles, expiration being decidedly prolonged. Vocal resonance and vocal fremitus were both rather diminished. Elsewhere over the chest the R.M. was feebler than normal, and accompanied by loud mucous râles with considerable wheezing in expiration, expiration being also unduly prolonged. Respirations rapid, from 34 to 50 per minute throughout the attack. Pulse varied from 100° to 134° F., swinging with the temperature; temperature for quite three weeks ranged from 100° to 104° F., fluctuations being very marked and quite irregular. Expectoration from the first was markedly purulent, being in fact pure pus; it was not nummular, but in the spittoon ran into a homogeneous greenish-yellow viscid mass. Bacteriological examination

revealed large numbers of staphylococci, streptococci, and pneumococci. Cough was painful and frequent, and expectoration was brought up with considerable difficulty.

Physical signs varied very little till about the twenty-first day, when the temperature fell rather rapidly to the normal level and remained normal. Breathing then became slower, respirations deeper and fuller and less loaded with mucous râles, while expectoration became less frothy and less purulent, until at last it ceased.

Treatment.—Hourly feeding, with milk and thickened soups alternately; a mixture containing iodide of potassium and creosote; a hypodermic injection twice daily of 20 minims of sterile almond oil holding in solution four per cent each of iodoform and guaiacol. Stimulants were given freely, strychnine hypodermically as required, and oxygen inhalation when the lividity was most marked. One dose containing 200 millions of an autogenous vaccine prepared from the patient's expectoration, containing staphylococci, streptococci and pneumococci was injected subcutaneously. On February 6, 1918, this man was well enough to be sent to another auxiliary hospital on the Firth of Clyde.

Remarks.—This man passed through a most serious illness, and for many days seemed to be on the brink of death. The points in the treatment on which I place most stress, apart from feeding and stimulants, are the use of the creosote and iodide mixture and of the hypodermic injection of iodoform and guaiacol. The oily solution above mentioned holds while hot four per cent of iodoform quite easily, but a little of the drug is thrown down on cooling. The percentage of guaiacol could be increased to at least eight or ten per cent, but I have found the four per cent satisfactory in use. As both of these drugs, but more particularly the guaiacol, are eliminated from the system mainly by way of the pulmonary mucous membrane, and practically unchanged, it is reasonable to assume that they exercise an antiseptic influence in the process of elimination.

I may add that I have under my care at the present moment a civilian in the wards of the Victoria Infirmary, Glasgow, passing through an exactly similar attack, and under the same line of treatment.

NOTE ON AN EPIDEMIC OF JAUNDICE IN THE WAZIRISTAN FIELD FORCE.

By Lieutenant-Colonel C. H. L. MEYER, I.M.S.
Consulting Physician, Waziristan Field Force.

Cases of jaundice began to appear in the Waziristan Field Force early in June and became increasingly numerous up to the middle of September, the percentage of attacks in the Force rising rapidly. Altogether about 300 cases have been noted, but the number was probably somewhat greater than this. The condition affected both the North and South Waziristan Field Forces and attacked British and Indian officers and privates in about equal ratios.

Clinically the cases in many instances resembled ordinary catarrhal jaundice. In some there was disturbance of the alimentary organs in the form of anorexia, vomiting, diarrhœa, or constipation. The majority of the cases were associated

with *fever* which sometimes preceded, sometimes ushered in the attack, and in other instances again only appeared after the establishment of the jaundice. These febrile attacks were not severe and usually were of short duration.

The liver was enlarged in about fifty per cent of the cases and in a few was also tender on pressure. No enlargement of the gall-bladder could ever be made out. There was tenderness on pressure in the epigastric fossa in some instances.

The spleen was enlarged in about twenty-five per cent of the cases and when this was so the enlargement resembled in all respects the malarial spleen.

The duration of the jaundice attacks varied from one to four weeks and the depth of the conjunctival and cutaneous discoloration from the slightest icteric tint to the deepest staining ever seen in cases of obstructive jaundice.

Three cases to my knowledge, one British and two Indian (and there may have been others), terminated fatally with much the same symptoms, viz., with the sudden onset, during the jaundice, of vomiting, great restlessness, passing into delirium stupor and finally death in deep coma after two or three days. In the first of these cases seen in No. 14 Indian General Hospital, as the result of a careful examination, I came to the conclusion that the patient's death was due to *acute* (*yellow*) *atrophy* of the liver. In the second Indian case, also in No. 14 Indian General Hospital, I suspected death to be due to the same cause, but the evidence here was not so strong as in the first patient. In neither of the above was a post-mortem obtainable. On the British soldier who died in No. 18 British General Hospital with much the same symptoms, a necropsy was performed, and the liver was found to be small, soft, and wrinkled, and to weigh only forty ounces. Sections of the organ were prepared for me by my friend, Major Glen Liston, I.M.S., of the Government Laboratory, Parel, Bombay, and he reported that they show the typical appearances microscopically of acute yellow atrophy of the liver.

Ætiology.—Inquiries into the causation of the jaundice were carried out by Captain Rutherford, R.A.M.C., and myself by the usual methods; viz., blood-film and blood culture, the inoculation of the blood of patients into guinea-pigs and rabbits and culture of the fæces and bile containing urine. Two attempts were made to obtain bile from the gall-bladder directly, by needling, but were unsuccessful as the gall-bladder was not enlarged. As previously noted, distension of this viscus was never found in any of the cases. The object aimed at here was to try and obtain cultures from the bile itself. Blood was drawn from the liver in two cases for culture, but further attempts were held to be unjustifiable owing to the known ready tendency to hæmorrhage in jaundice. It is known that picric acid, taken even by small doses over a period, will produce jaundice, and therefore the rations and the lime-juice of the troops were examined by us for the presence of this substance. The tests, however, were negative. It was thought that, possibly, picric acid might have been added as a preservative or colouring agent.

Conclusion.—From the positive and negative evidence obtained, I am of opinion that the jaundice which affected the Waziristan Field Force is what is known as "toxic," "infective," or "camp jaundice," identical with the condition which was common in the American Civil War and the South African campaign, and which is thought by some to be brought about by insanitary camp conditions. It is, I believe, undoubtedly due to a definite bacterial infection and some of the

investigations made by Captain Rutherford and myself seem to point to the possibility that an organism of the enteric group, probably closely allied to the paratyphoids, might be the causative agent. There was no evidence that malarial or spirochætal infection were causes of the condition. Lastly, I consider that there is some justification in hinting that the coli-infected surface waters consumed by the Waziristan Field Force may have played some part in the production of the epidemic.

A CASE OF LIGATION OF THE FIRST PART OF THE LEFT SUBCLAVIAN ARTERY.

By Colonel Sir CHARLES BALLANCE, K.C.M.G.
Army Medical Service.

Private K., Dublin Fusiliers, aged 31, was admitted to Cottonara Hospital, Malta, under the care of Lieutenant-Colonel Dundon, R.A.M.C., on January 13, 1918, from Salonika.

History.—Before joining the Army he had been in the Navy, from which he was discharged; reason unknown. No history of syphilis. In July, 1916, he was wounded by a shrapnel bullet in the left supra-clavicular region. The wound was just above the middle of the clavicle and had healed. He had recently had an attack of tertian malaria.

On Admission.—Patient complains of numbness and shooting pains in the left arm and hand with muscular weakness. A well marked pulsating tumour can be seen and felt above the left clavicle; an area of dullness continuous with this swelling extends for two inches below the inner half of the clavicle. The radial pulse can only just be felt at the wrist but the arm is quite warm. X-ray examination shows the presence of a tumour, part of which is in the chest cavity, and the rest, curving over the first rib, extends into the root of the neck (figs. 1 and 2). It seems more dense in the lower part, probably on account of organized blood-clot in the aneurysmal sac (fig. 3). A shrapnel bullet is lodged in the right side of the chest at the level of the seventh rib. It has not been definitely localized as there is no likelihood of its being removed. A diagnosis of aneurysm of the second and third portions of the left subclavian artery was made and it was decided to ligate the subclavian on the proximal side of the aneurysm. Anti-syphilitic remedies had no effect.

Operation, February 4, 1918.—A general anæsthetic was given by Lieutenant-Colonel Shirley with the Vernon-Harcourt apparatus. An incision was made along the anterior border of the lower half of the sterno-mastoid down to the manubrium and another horizontally along the inner half of the clavicle. The common carotid artery, internal jugular vein, and vagus nerve were exposed in the middle of the neck and the dissection was continued downwards, keeping well towards the middle line of the neck, as the wall of the aneurysm extended in this direction and was very thin. The fingers of the left hand protected the wall of the aneurysm from injury. More room was required, so the inner third of the clavicle was resected, by division with a Gigli saw and disarticulation at the sterno-clavicular joint. The dissection became increasingly difficult, the aneurysm

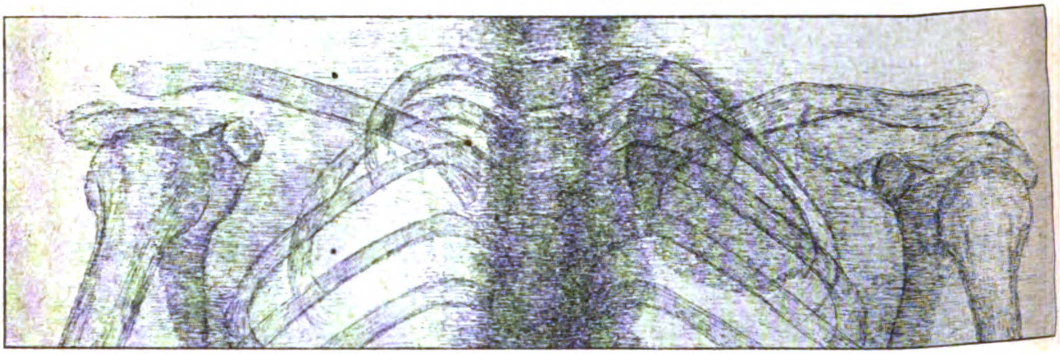

FIG. 1.—Sketch by Captain Crowe, R.A.M.C., of the upper part of the chest from X-ray plates and screen examination. The position of the aneurysm is seen.

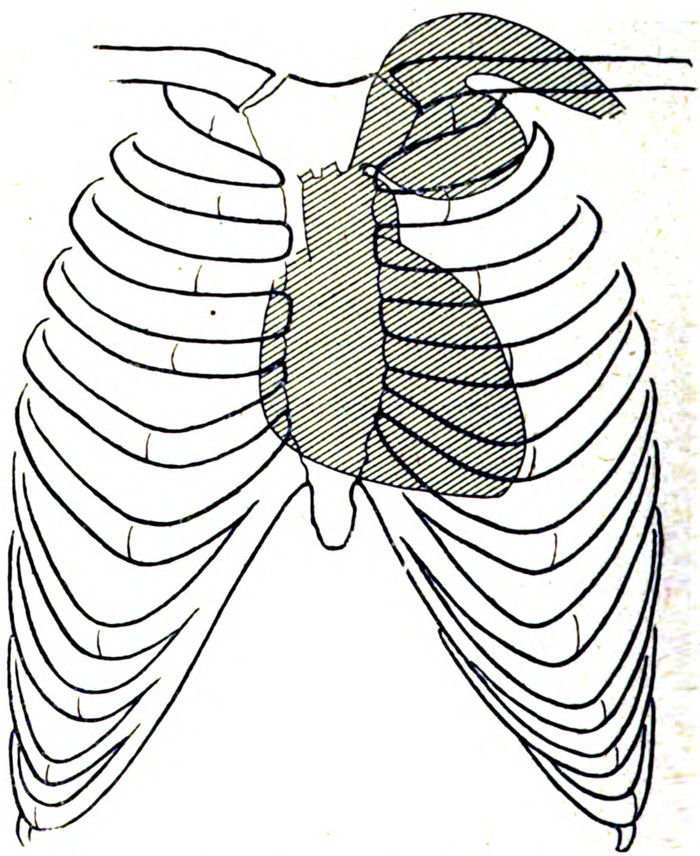

FIG. 2.—Sketch by Captain Crowe, R.A.M.C., of the position of the heart and aneurysm from X-ray screen examinations.

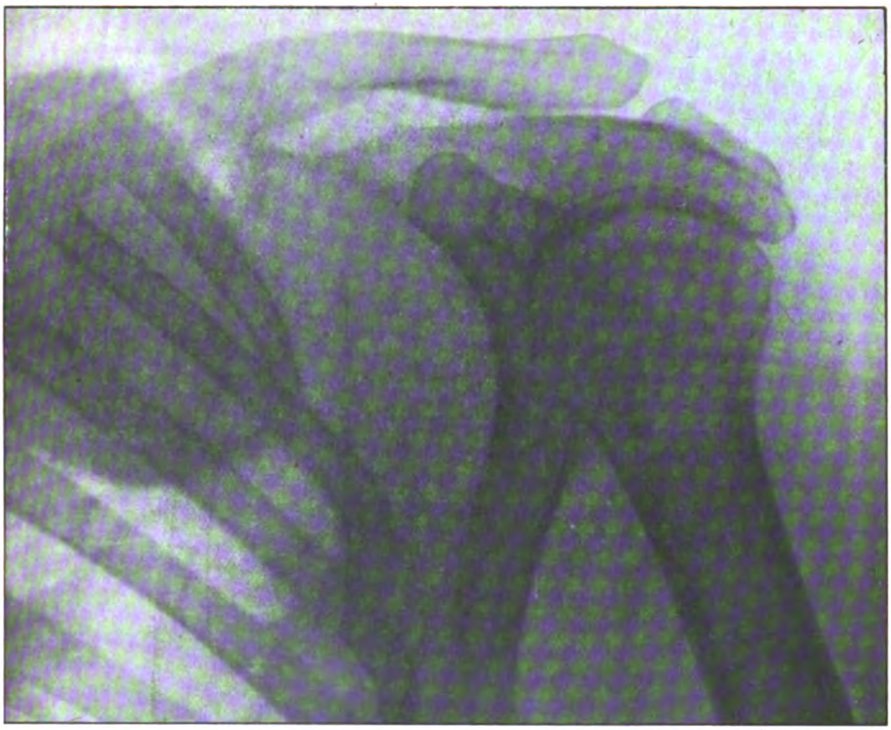

FIG. 3.—Radiogram taken on January 26, 1918, showing position of aneurysm before operation. The indistinct cervical border is due to the constant movement—pulsation.

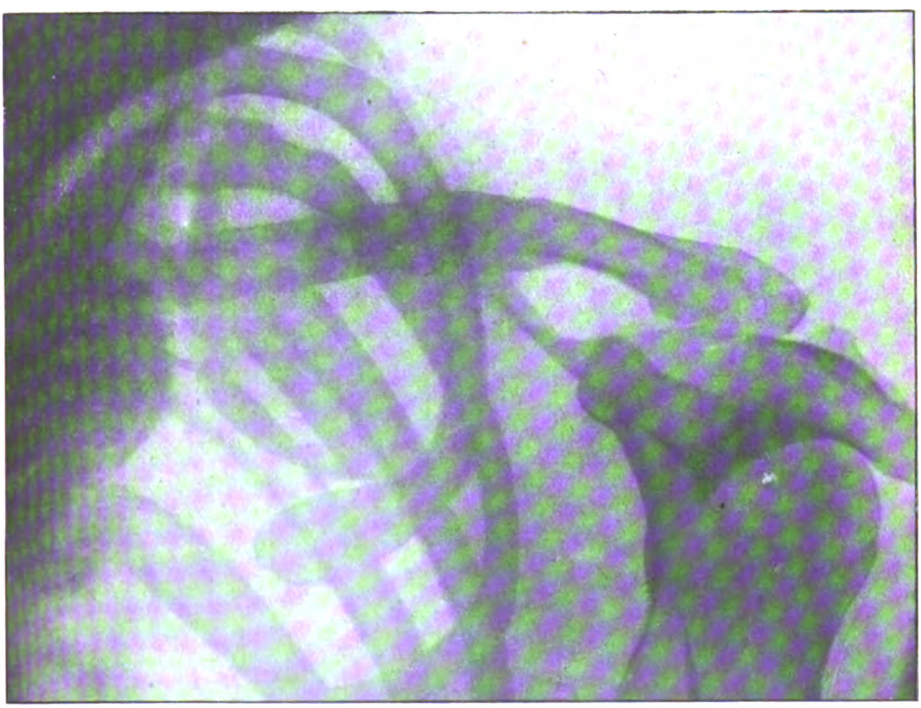

FIG. 4.—Radiogram taken on March 15, 1918, showing consolidation of aneurysm and a distinct border or outline to the cervical portion.

To illustrate "A Case of Ligation of the First Part of the Left Subclavian Artery," by Colonel Sir CHARLES BALLANCE, K.C.M.G., A.M.S.

and internal jugular vein had to be gently pressed outwards with the fingers while the common carotid artery and vagus nerve were retracted inwards with a copper retractor. The deeper part of the tumour was nearer the middle line than the superficial part; the vessel had probably been injured at the junction of the first with the second part, and the aneurysm had developed in front of the artery and displaced it and the dome of the pleura backwards as it increased in size. It had extended below the first rib through the upper opening of the thorax. At last the vertebral vein was recognized and behind it the artery was both seen and felt. It was cleared and ligated with three medium-sized strands of kangaroo tendon tied in a stay knot. Pulsation in the aneurysm immediately ceased. The patient left the table in good condition. I was admirably assisted in the operation by Captain James Anderson, R.A.M.C.

Progress.—No untoward symptoms followed the operation and the wound healed throughout by first intention. Five weeks after operation the patient had an attack of malaria, tertain parasites were found in the blood. Tartar emetic (0·04 to 0·12 gramme) and quinine bihydrochloride (15 grains) were injected intravenously on alternate days. The fever did not recur.

Radiograms taken after the operation show progressive consolidation of the aneurysm. This is most marked in the upper part. Before operation the part above the clavicle showed no defined border but only a fluffy edge from the constant pulsating movement during the exposure of the plate. In the later photograph taken some time after the operation this upper part shows a well-defined outline (fig. 4).

With the contraction of the aneurysm the pain and weakness of the upper extremity exhibited week by week progressive improvement.

No evident inconvenience resulted from the loss of the inner third of the clavicle; the arm, when he left hospital, was in excellent condition and could be moved in any direction. The clavicle became fixed to the first rib.

The rarity of ligation of the first part of the left subclavian gives an interest to this case.

Report.

AN INVESTIGATION INTO THE INCIDENCE OF ALBUMINURIA AND CASTS IN BRITISH SOLDIERS DURING TRAINING AND THE RELATIONSHIP OF THIS CONDITION TO WAR NEPHRITIS.

By Captain H. MacLEAN.
Royal Army Medical Corps.

Report to the Committee on War Nephritis.

(The Medical Research Committee provided the services of Captain H. MacLean.)

(*Continued from p.* 337.)

(7) The Relation of Age to Incidence of Albuminuria and of Casts.

The relation of age to incidence of albuminuria was investigated in three groups of 10,000 men each. The groups selected were Nos. 3, 4, and 5, already described. According to the results obtained, the incidence of albuminuria does not vary with age to any appreciable extent, though the amount was found to be somewhat greater in the younger men from 18 to 23 than in those over 25. This is well brought out in each group of 10,000 examined here; but, strange to say, a group of young men examined at Aldershot did not show this tendency to any extent. From 25 to somewhat over 40 the incidence of albuminuria remains fairly constant, while after 40 it tends to decrease somewhat. These statements hold for well-marked albuminuria as well, for here also there is the same high value in the younger soldiers, and a comparatively constant incidence afterwards up to nearly the age limit of 42, when a decrease is indicated.

In the groups of men examined, no account was taken of those aged 17 or under, so that the actual number investigated falls a little short of the 30,000 comprised by the three groups; it amounts, however, to considerably over 29,000.

The average number per 1,000 of men from 18 to 22 years of age suffering from albuminuria was 83, while the numbers for successive periods of five years were 59, 62, 57, 56, and 44 per 1,000.

For well-marked albuminuria the corresponding figures were 41, 29, 27, 31, 26, and 22 per 1,000.

Casts gave 22, 21, 23, 20, and 19 per 1,000.

These results are given in tabular form below (Table XLII).

TABLE XLII.—Average Albuminuria in Total Number of Men examined; also Well-marked Albuminuria (A, B, C, D Grades).

Age period	Average number per 1,000 with albuminuria	Average number per 1,000 with well-marked albuminuria
18 to 22 years	83	**41**
23 ,, 27 ,, ...	59	**29**
28 ,, 32 ,, ...	62	**27**
33 ,, 37 ,, ...	57	**31**
38 ,, 42 ,, ...	56	**26**
43 years and over	44	**22**

The following tables are arranged on the same lines as those in the preceding part of this paper dealing with the relation of training to albuminuria, and are self-explanatory. They contain all the details connected in this investigation on age. Evidently this factor plays no part in the etiology of albuminuria in the Army. Even in the case of such a combination as well-marked albuminuria associated with large numbers of epithelial or hyaline casts, no relation of age can be discerned. (Table XLVIII).

TABLE XLIII.—RELATION OF AGE TO INCIDENCE OF ALBUMINURIA N THIRD GROUP OF 10,000 MEN EXAMINED.

Age	Number of men of given age in group examined	Number of men of given age with albumin	Percentage of men with albumin at different ages
18	26	6	23·0
19	1,114	108	9·7
20	717	67	9·3
21	648	49	7·6
22	612	36	5·9
23	506	38	7·5
24	519	36	6·9
25	474	27	5·7
26	432	30	6·9
27	396	15	3·8
28	357	30	8·4
29	393	23	5·8
30	377	17	4·5
31	353	26	7·3
32	322	25	7·7
33	280	16	5·0
34	250	22	8·8
35	284	17	6·0
36	276	11	4·0
37	218	15	6·9
38	235	16	6·8
39	178	9	5·0
40	191	15	7·8
41	166	7	4·2
42	110	7	6·3
43	46	1	2·2
44	30	2	6·6
45	23	2	8·7
46 and over	70	3	4·3

TABLE XLIV.—RELATION OF AGE TO WELL-MARKED ALBUMINURIA (A, B, C, D GRADES) IN THIRD GROUP OF 10,000 MEN.

Age	Number of men in group	Number of men with well-marked albuminuria in group	Percentage of men with well-marked albuminuria in each group
18	26	4	16·0
19	1,114	48	4·3
20	717	29	4·0
21	648	17	2·6
22	612	15	2·4
23	506	16	3·1
24	519	19	3·6
25	474	13	2·7
26	432	17	3·9
27	396	6	1·5
28	357	16	4·5
29	593	7	1·8
30	377	4	1·0
31	353	7	2·0
32	322	11	3·4
33	280	5	1·8
34	250	12	4·0
35	284	6	2·1
36	276	6	2·1
37	218	8	3·7
38	235	9	3·8
39	178	4	2·2
40	191	9	4·6
41	166	2	1·2
42	110	6	5·4
43	46	—	—
44	30	1	3·3
45 and over	93	3	3·2

TABLE XLV.—INCIDENCE OF TOTAL ALBUMINURIA AND OF WELL-MARKED ALBUMINURIA (A, B, C, D GRADES) IN THIRD GROUP OF 10,000 MEN, IN DIFFERENT AGE PERIODS.

Age period	Number of men in each period	Total number of men suffering from albuminuria of all grades in each period	Average per 1,000	Total number of men suffering from well-marked albuminuria (A, B, C, D grades) in each period	Average per 1,000
18 to 22 years inclusive..	3,117	266	85	113	36
23 to 27 ,, ,, ..	2,327	146	63	71	30
28 to 32 ,, ,, ..	1,802	121	67	45	25
33 to 37 ,, ,, ..	1,308	81	62	37	27
38 to 42 ,, ,, ..	880	54	61	30	34
43 years and over ..	169	8	48	4	24

TABLE XLVI.—Relation of Age to Presence of Casts of all Kinds in Third Group of 10,000 Men examined.

Age	Number of men of given age in each group	Number of men of given age with epithelial casts	Number of men of given age with hyaline casts	Total number of men of given age with casts	Percentage of men of given age with epithelial casts	Percentage of men of given age with hyaline casts	Total percentage of men of given age with casts
19	1,114	15	14	29	1·35	1·25	2·6
20	717	10	6	16	1·4	0·8	2·2
21	648	4	6	10	0·6	0·9	1·5
22	612	5	8	13	0·8	1·3	2·1
23	506	3	5	8	0·6	1·0	1·6
24	519	7	1	8	1·3	0·2	1·5
25	474	6	3	9	1·3	0·6	1·9
26	432	5	5	10	1·15	1·15	2·3
27	396	5	3	8	1·2	0·8	2·0
28	357	3	9	12	0·9	2·4	3·3
29	393	2	4	6	0·5	1·0	1·5
30	377	4	2	6	1·0	0·6	1·6
31	353	7	4	11	2·0	1·1	3·1
32	322	3	2	5	0·9	0·6	1·5
33	280	1	4	5	0·4	1·4	1·8
34	250	4	5	9	1·6	2·0	3·6
35	284	2	4	6	0·7	1·4	2·1
36	276	1	1	2	0·4	0·4	0·8
37	218	2	3	5	0·9	1·4	2·3
38	235	5	1	6	2·1	0·4	2·5
39	178	1	1	2	0·55	0·55	1·1
40	191	1	1	2	0·5	0·5	1·0
41	166	2	2	4	1·2	1·2	2·4
42	110	1	2	3	0·9	1·8	2·7
43	46	—	1	1	—	2·1	2·1
44	30	—	1	1	—	3·3	3·3
45 and over	93	1	3	4	1·0	3·3	4·3

TABLE XLVII.—Incidence of Casts in Different Age Periods in Third Group of 10,000 Men examined.

Age period	Number of men in each period	Number of men with casts in each period	Average per 1,000
19 to 23 years inclusive ..	3,597	76	21
24 ,, 28 ,, ,, ..	2,178	47	22
29 ,, 33 ,, ,, ..	1,725	33	19
34 ,, 38 ,, ,, ..	1,263	29	22
39 ,, 43 ,, ,, ..	691	12	17

TABLE XLVIII.—Relation of Age to Incidence of Albuminuria associated with many Epithelial and Hyaline Casts in Third Group of 10,000 Men examined.

Age	Number of men of given age in each group	Number of men with casts in each age group	Percentage of men with casts in each age group
From 19 to 23 inclusive ..	3,597	35	0·97
,, 24 ,, 28 ,, ..	2,178	26	1·2
,, 29 ,, 33 ,, ..	1,725	18	1·0
,, 34 ,, 38 ,, ..	1,263	6	0·5
,, 39 ,, 43 ,, ..	691	6	0·9

TABLE XLIX.—Relation of Age to Incidence of Albuminuria in Fourth Group of 10,000 Men examined.

Age	Number of men of given age in group examined	Number of men of given age with albumin	Percentage of men with albumin at different ages
18	49	5	10·0
19	1,129	92	8·1
20	770	38	5·0
21	673	63	9·3
22	623	47	7·4
23	594	33	5·5
24	518	34	6·6
25	486	18	3·7
26	466	29	6·2
27	460	30	6·5
28	414	17	4·2
29	373	26	7·0
30	391	27	6·9
31	337	13	3·9
32	294	16	5·5
33	277	15	5·4
34	266	13	4·9
35	280	14	5·0
36	290	19	6·6
37	219	16	7·3
38	189	12	6·3
39	261	13	5·0
40	241	16	6·6
41	176	9	5·1
42	134	7	5·2
43	71	1	1·4
44	49	4	8·2
45	32	1	3·1
46 and over	75	2	2·7

TABLE L.—Relation of Age to Well-marked Albuminuria (A, B, C, D Grades) in Fourth Group of 10,000 Men.

Age	Number of men in group	Number of men with well marked albuminuria in group	Percentage of men with well-marked albuminuria in each group
18	49	3	6·0
19	1,129	40	3·5
20	770	18	2·4
21	673	35	5·2
22	623	29	4·6
23	594	15	2·5
24	518	16	3·1
25	486	10	2·0
26	466	15	3·2
27	460	14	3·0
28	414	9	2·1
29	373	11	2·9
30	391	17	4·3
31	337	7	2·0
32	294	6	2·0
33	277	5	1·8
34	266	4	1·5
35	280	9	3·3
36	290	9	3·1
37	219	4	1·9
38	189	6	3·1
39	261	5	1·9
40	241	5	2·0
41	176	3	1·6
42	134	1	0·8
43	71	—	—
44	49	4	8·1
45 and over	107	—	—

TABLE LI.—Incidence of Total Albuminuria and of Well-marked Albuminuria (A, B, C, D Grades) in Fourth Group of 10,000 Men, in Different Age Periods.

Age period	Number of men in each period	Total Albuminuria		Well-marked Albuminuria	
		Total number of men suffering from albuminuria of all grades in each period	Average per 1,000	Total number of men suffering from well-marked albuminuria (A, B, C, D grades) in each period	Average per 1,000
18 to 22 years inclusive..	3,244	245	75	125	39
23 ,, 27 ,, ,, ..	2,524	144	57	70	28
28 ,, 32 ,, ,, ..	1,809	99	55	50	28
33 ,, 37 ,, ,, ..	1,332	77	59	31	45
38 ,, 42 ,, ,, ..	1,001	57	57	20	20
43 years and over ..	227	8	35	18	18

TABLE LII.—RELATION OF AGE TO PRESENCE OF CASTS OF ALL KINDS IN FOURTH GROUP OF 10,000 MEN EXAMINED.

Age	Number of men of given age in each group	Number of men of given age with epithelial casts	Number of men of given age with hyaline casts	Total number of men of given age with casts	Percentage of men of given age with casts
19	1,129	10	12	22	1·9
20	770	3	11	14	1·8
21	673	10	13	23	3·4
22	623	9	6	15	2·4
23	594	2	4	6	1·0
24	518	7	6	13	2·5
25	486	3	1	4	0·8
26	466	5	4	9	1·9
27	460	5	6	11	2·4
28	414	5	2	7	1·7
29	373	3	4	7	1·9
30	391	5	5	10	2·5
31	337	2	1	3	0·9
32	294	—	8	8	2·7
33	277	1	5	6	2·1
34	266	1	4	5	1·8
35	280	3	3	6	2·1
36	290	3	3	6	2·0
37	219	3	3	6	2·7
38	189	4	1	5	2·6
39	261	4	1	5	1·9
40	241	1	1	2	0·9
41	176	1	4	5	2·8
42	134	2	—	2	1·5
43	71	—	—	—	—
44	49	1	2	3	6·0
45	32	—	—	—	—
46 and over	75	—	1	1	1·3

(*To be continued.*)

Review.

CLINICAL CASE TAKING. By R. D. Keith, M.A., M.D. H. K. Lewis. 1918. Pp. 104. $7\frac{1}{4} \times 4\frac{5}{8}$.

This little work should prove very useful to medical students who are about to commence their duties as clinical clerks in the medical wards, and can be confidently recommended to them.

The author writes in a clear and lucid style and uses simple language. In the preface he refers to the absence of illustrations which it was originally intended to employ. This is to be regretted as they would enhance the value of the book.

In the scheme for the clinical examination of a medical case no mention is made of examination of the rectum—a procedure too often neglected, and sometimes fraught with disastrous consequence to the patient. Any reference to the examination of the genital organs is also omitted. The chapter on the urine is excellent and contains a vast amount of information in a small space.

The book as a whole is eminently practical and should prove a valuable guide to those for whom it is primarily intended.

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SOME MUSINGS OF AN IDLE MAN.

BY COLONEL R. H. FIRTH.

I WRITE these notes in the congenial surroundings of a wood in France,[1] where all around I see daffodils, primroses, anemones, violets and all the characteristics of spring. The air seems alive with the music of Nature's overture, preluding the great opera and spectacle of summer. All about is Nature's peace, and yet the intermittent shriek-like moan of a shell, the vicious barking of an adjacent battery and the more distant staccato notes of a machine gun bring home the thought and realization that not far away there is no peace but only evidence of man's insensate cruelty to man with all its associated misery and suffering, made yet so wonderful by man's own silent heroism. Of what that silent heroism is, my morning's round of advanced dressing stations and field ambulances has given me only too true a picture; but here in the late afternoon I want to forget and for awhile do forget, lulling myself into a false belief that things are as they ought to be.

It is difficult to suppress serious and sad thought, but as I look around me it is only too obvious that Nature is not at all interested in man's grief. She seems to be indifferent, but yet she is not callous, for, even here, I am conscious of a welcome indicative that, to those who seek her, Nature is willing to extend the hand of fellowship. The indifference of Nature to our woe is largely due to the fact that she is too busy, and the combination of the evidence of her toil and beauty holds attention and entrances. As I sit here I note poplars with catkins in full bloom all powdered with roan, alders tinted with a pale and duller red, and hazel bushes at a distance all dusted with a greenish yellow, while peeping out from some moss-covered

[1] Near Gorré. April, 1917.

stones three blooms of gentian glint as little stars, whose blue seems to be an expression of their eager but somewhat cramped life. But what appeals to me is the multiplicity of this eager life, suggesting a choir of clear voices singing together a song that no one had taught them.

With idle thoughtless whim, I pluck a bud from a tree branch within reach. A glance upward shows it to be from a chestnut tree. The bud-case within my hand reveals the leaves and flower buds of the horse-chestnut packed and folded with a precision beyond the ability of the most human handicraft. The more I look at it, the stronger appears the difference between any human craftsmanship and the natural growth of the bud. I do not merely feel that the fashioning of the leaves, the soft down in which they are compressed, and the sticky scales which enclose them are beyond the skill of the most deft human hand, but I know that no human hand can make a bud which expands day by day into the fuller bloom. Not only is it a matter of man's inability to make or originate such a living thing but also his inability for dealing with it. The tree above me indicates that Nature must have taken thirty years to raise it from nut to seedling and then on to its present maturity. True, the same stream of life is in man, but in dealing with human affairs we forget that the mature character which we desire can only be obtained by cultivating it fitly from the beginning. We cannot shape a living thing to our liking by any summary methods of craftsmanship such as we apply to a lock or boot. Unless the desired character is already in man and been developed by a long train of circumstances it is as hopeless to expect it to burst its wrappings at a liberating touch as it is to expect the production of the bud in my hand apart from the tree from which I plucked it. In both cases, the imitation would be a thing without life.

Again, as I sit face to face with the serene and secluded beauty of the place the question crops up, not so much why it should exist as why I or mankind exist. As contrasted with the perfections of the flowers, the grasses and the trees around me, the deficiencies of our own unsatisfied nature are emphasized. The superiority of human life over that of the flowers, trees and grasses lies assuredly in no achieved perfection but in the possession of a will to act and a moral consciousness which makes perfection inaccessible and disaster an ever-present contingency. By our mental process, I and other men are freed largely from an obedience to a settled order of times and seasons such as controls the natural world. It is this partial emancipation from natural law which distinguishes us from the other animals and makes us human. But this freedom from natural restrictions has its penalty and that penalty is our capacity for excess. The very sounds in my ears of not-far-distant war are an eloquent reminder of how men perish of their own excess. Because our life is better and fuller than that of the trees, flowers and grasses it can become unspeakably worse. The serene and soulless world is incapable of the degradation to which the possession of an intellect and will can lead man, if the dictates of morality

become obscured: and the very flowers, trees and grasses around me warn us to take care lest the qualities by which we excel in Nature become its greatest profanation. On this matter, I recall the words of Wordsworth and am tempted to say:

> "One impulse from the vernal wood
> Can teach us more of man,
> Of moral evil and of good,
> Than all the sages can."

II.

When on recent leave, I found time one day hanging somewhat heavily, so took a stroll along the more crowded thoroughfares of London. While doing so, it occurred to me to note the complexions of passers by. Excluding those of obviously foreign origin, I soon noted what a small proportion of fair complexioned people passed me. I use the term "fair" as meaning flaxen or yellow hair with grey, green or blue eyes. My wanderings took me through the western half of Oxford Street, Bond Street, Piccadilly, the Strand, Fleet Street, through the City and back by Moorgate Street, Newgate Street, Holborn and the eastern half of Oxford Street. The conclusion I reached was, that rather more than one-third of the persons I met in those thoroughfares had black or nearly black hair, one half had dark brown hair and about one-seventh light brown. The percentage of really fair-complexioned people I found to be comparatively small.. The results as noted gave cause for thought, as we still assume that our natural complexion is fair. So impressed was I with the observed facts, that a few days later I devoted a week-end to making corresponding observations in portions of Yorkshire. While the totals observed in that rural area were less, a very definite increase in the proportion of people who could be classed "fair" was noted.

Now the question arises, what do the facts indicate? The answer lies in the appreciation of another fact, and that is that a like increase of dark complexioned people is observable everywhere. Central Europe, now occupied mostly by short-headed, dark-haired people, was once the home of a pure long-headed, tall and fair stock. I write without reference to exact literature, but I believe the last figures for the whole German army gave 30 per cent. blonde conscripts, while in Prussia proper the blondes were about 70 per cent. In Sweden and Norway, the fair type constitutes 76 per cent. But in each of these countries the proportion of "fair" is falling. The well-marked long-head is characteristic of the early Teuton stock to which our forefathers belonged. We still claim the lineage but with a diminishing right. Correlative with the long skull are tall stature, yellow or flaxen hair and grey or blue eyes. The Norwegians and Swedes come nearest to this type in these days. By a long-head is meant that type of skull which anthropologists call dolichocephalic: that is, its length

exceeds the breadth by a quarter or so. A short-headed individual means a person known as a brachycephalic, or in whom the length of skull exceeds the breadth by only a fifth or an eighth.

If history be any guide, we may infer that restless energy is the special attribute of the dolichocephalic races. Certainly, the record of the Scandinavian nations supports the view that they were adventurous. Above all, the long-headed or dolichocephalic is and has been a man of action and ideas, restless, fond of his home but easily tempted to leave it, greedy but thoughtless, better qualified to gain than to hold property, impatient of regular work, kind and good tempered, but subject to fits of ferocity. In truth, the long-headed or blonde race has been the disruptive element in European history, if not elsewhere. There is much to suggest that it came into the world late, possibly representing a late stage of evolution, and destined to break up or reform the established order of things when it grew powerful enough. On the other hand, the short-headed peoples are abhorrent of change. Laborious, economical, submissive, temperate, they are content with little and save upon it. Distrustful by nature, they do not move willingly. War has no charm for them, though they do not lack courage. Adventure would seem to repel them as a race-stock, preferring to till their fields, thrive and multiply.

Unless some unrecognized fallacy underlies these thoughts, complexion is a mark of race and a visible token of character. Nearly all the conquering and colonizing nations have been fair. The Assyrians seem to have been the one exception or, at least, we have no definite record that they were fair. The Athenians and Macedonians were certainly fair. There is no dark hero to be found in the "Iliad," and all the women and goddesses of Homer were fair. The early Romans were fair and tall, though dark and small in Julius Cæsar's day. Yet Cæsar himself was fair and Cato red-headed. Persians, Medes, Greeks, Gauls, Teutons, Slavs, Norsemen, Venetians, British and the Berbers, who conquered Spain, were all fair complexioned. In each and every case, as the times settled down a darker, short-headed race pushed to the front and the restless energy of the fair long-headed type ceased to be formidable. I have heard it said that we ourselves conquered India while we were fair but that we are doing our best to lose it as we darken. *Absit omen*, but one's musings lead to the thought that the gradual change in our national complexion denotes a reconquest of our islands; and that after the incursions of the Norsemen, Saxons, Danes and fair Normans, the ancient Briton is coming to his own again.

There is ever a danger in generalizations, but it is only too apparent that the conditions of modern life do not favour the roving adventurous spirit. Its day is past, and with its departure its physical type of man is going. Men so endowed obey their instinct unconsciously as evidenced by the deeds and initiative of our race in this war. But it comes to this, that the small, dark, short-headed race is better fitted for industrialism

which is the stamp and object of our civilization. It is for this reason that we find our old-time national type growing scarcer in the streets, less so in the country lanes or fields, but doubtless to become more scarce there later on. Certainly many factors are at work in bringing about this change of complexion. More than one observer has remarked how town life is obnoxious to persons of the fair complexion. When conditions are favourable, the blondes seem nearly to hold their own. It is a pity that we have not more exact statistical facts as to complexions, supported by reliable cranial measurements. Perhaps some day they will be forthcoming, and we shall then know how far the old fair dolichocephalic survives in our midst. If physiognomies can be trusted the type is rapidly disappearing, but what will that matter so long as the bold adventurous spirit remains? The theme is well worth developing on a basis of exact data and perhaps these musings of an idle man may stimulate some industrious man to collate the facts, if only to show that these ideas of the idler were based on a misconception.

III.

Have just finished reading two autobiographies, in neither of which does the writer make any attempt to gloss over or hide his mistakes or the follies of earlier days. The books have been amusing reading, but raise the thought, how much the world prefers pasts to presents, and how few people would care to read books concerning what So and So is and what he hopes to become. Such volumes would be merely books of good intentions and no one cares about good intentions, especially as a certain road is said to be paved with them. It has often occurred to me, what funny books they would be if we kept diaries, on one side of which we entered what we intended to do and upon the other what we actually did. Most of us in our youth have set out to remove mountains and, as we look back on our lives we realize only too clearly that the sum total of our efforts has been to kick over a molehill. Very few of us can go straight along the road which we feel our lives ought to follow; pity, love, hatred, health or the influence of others have so often turned us from our intentions. It would appear as if our good intentions go without reward and our bad intentions unpunished. It seems a mystery, and very suggestive of a scheme wherein the weak suffer for the strong, the good for the bad and those of good intentions for those who never had any at all.

But what of the past, be it our own or that of those who write autobiographies? The cynic will say that the wise will keep the past to themselves, unless an honest penny can be made by revealing it to a curious world. The well-advised will not be tempted to earn that so-called honest penny. The world consists of those who have been and those who have not been found out, and there is always an unexpressed sympathy in the hearts of the latter for the former and less fortunate. It suffices that we are what we are, and presumably fortified by the hope to be what we have

always desired to become; so, let us take ourselves as we wish to be taken, and take others as we wish they would take us. It is a false philosophy to assume that the foolishness of yesterday or the evil we have thought or done can be any help either for the present or the future, so far as it affects others. As affecting ourselves, any merit associated with such past peccadilloes can only accrue by virtue of our present real sorrow and shame as to them. It goes too far to say that if a man never fall he can never rise; but it is true that the person whose temperament and character never lead him into temptation will never reach any great heights; he may not fall but he certainly will not rise, which means that he who has lived upon one dead-level can rarely have learnt a real lesson from life. In many cases, it is a lack of inclination or opportunity alone which separates the virtuous from the wicked.

Very few of us have gone through life without making mistakes, but having made mistakes we understand all the better the mistakes of others and so more readily forgive them. If a man fails of his best, the fault and the punishment are his alone. As I review my past years, I regret little that I have done. Certainly, I regret some things which I have done, but through regret, shame and sorrow we purge our hearts of much dross. Perhaps, in these events is born the soul's awakening.

> "But, whatever our faults, the purging
> Has cleansed us and purified;
> With heart and with brain we must build again
> Things of proof that shall abide."

* * * * * *

> "Each soul that strips it of one evil thing
> Lifts all the world towards God's good purposing."

IV.

Few of us who have served in France in the present war can have failed to be impressed by the high state to which agriculture has been raised in that country, and also to be impressed by the marvellous industry of the French peasantry. Often riding over the fields of the much maligned Low Countries, has it occurred to me how much agriculture is an art which appeals to the intellect as well as to the heart. A moment's reflection reminds one that the tilling of the fields has a traditional association with men's brains as well as with their hands, and those of us who can remember reading the Georgics must readily admit that, even from before the time of Virgil, agriculture has commanded the respect of the learned as well as of the unlettered. And why? Because the forces of Nature require all the wit of man to mould them to his own advantage, and on this simple fact the connexion between brains and mother earth is indisputable.

This thought acquires an additional interest now, for our daily paper is

full of allotment culture and other schemes to reinforce homegrown food. One wonders whether the awakening interest of the people at home in the oldest of the arts will serve to deepen and emphasize the happy union of brains and land, and that the educated classes may yet find in agriculture an Alma Mater which now they but little realize. There is nothing revolutionary in the thought, for the history of agriculture is full of instances of the keenness and delight which some intellectuals have found in husbandry, not merely as a refuge from the cares of town, but health, peace and means of livelihood.

The sceptic may quote the old rhyme, "He who by the plough would thrive, himself must hold the plough or drive," and argue that it is not a calling for amateurs. But is the objection valid? One is tempted to say, no, and that, like converts to a new religion, enthusiastic amateurs have more zeal and more application; in short, have fewer prejudices to surmount and more enthusiasm for the calling than those who have been brought up to it from infancy. Zeal and application are more than a set off against a want of detailed knowledge, and the value of the study of the principles which underlie farming or agriculture was recognized by educated men long before the days of agricultural colleges. Probably there exists no art of any magnitude, save agriculture, in which so much empirical and localized opinion, haphazard conclusion and superstitious reverence for tradition or precedent gains currency and secures a following. Freedom from prejudice is not the least asset which education brings and to be free from it all in farming is to start fair.

The State now recognizes the husbandman so lavishly that the game is worth trying. True, agriculture is the most variable and fortuitous of the arts, but she is a kindly mother to the children who trust her, and many of the war-shattered may find peace in her bosom. One cannot but wonder if and hope that the lesson may be taken to heart.

V.

The casual remark by a friend that "So-and-So must be a rich man," prompted the questioning thought "Why?" To say that a man is rich implies of course the fact that he is effectively wealthy. It so happens that the person of whom we were talking is a man credited with considerable financial resources, but one who does not spend much money and, owing to this failure on his part to exchange his wealth for something else, is regarded as being doubtfully rich by some of his acquaintances. The question arises, who is a rich man? A variety of definitions suggest themselves. Thus, a frivolous friend says a rich man is one who cannot enter the kingdom of heaven, or another may say he is a man who has to pay supertax. Perhaps a better and more obvious answer is, "He that has the means to get what he wants without thought or worry." If this be correct, presuming that So-and-So gets all he wants, then he may be

accounted to be a rich man in spite of his not spending all or the greater part of his income. Putting myself in the position of a man who has great financial resources, I am confronted with the possible difficulty that I may not know what I want. That is precisely the trouble which must and doubtless does worry many who are deemed rich and who have wealth. Again there are men, well endowed with money, who seek and desire power or patronage. It is questionable whether they can attain or exercise it by money alone; the essential of personality may be lacking and if so then such men may buy power but someone else will use it. This brings us up against the basic fact that, in spite of great financial resources, a man is more often than not baulked in the employment of them simply because he cannot want genuinely as much as he has the means to buy. Or, if he does genuinely desire or want so much, his conscience will not allow him to keep it. If we think a moment, we realize that the things which the majority of sane people want are not, in the Crœsus-sense, dear. I have an uxorious relative who would at once say that children are the only things sane people want, and certainly they are not dear in the millionaire sense. Hence, the man with great financial resources cannot necessarily make the full use of those resources and the mere possession of money does not make a man really a rich man.

I remember well being told as a boy that the only way to get rich was to earn a shilling and to spend but elevenpence. To me that was a policy of perfection and, in the light of present reflections, I can see that had I displayed such thrifty habits there might have come a day when if I earned more than a certain number of shillings I should not be able effectively perhaps to spend elevenpence out of each of those shillings. It was very good advice but presented a serious check on ambitions and no negligible premium upon making me a man of small ideas and restricted outlook. Doubtless there are many who have gone through their best years actuated by such a policy. But, what has been their gain? Something saved against a rainy day perhaps, but, since they neither think rich nor act rich, we cannot call them rich. Not only that, they have not the merit of being overtly poor. The best that can be said of them is, they are or have been cautious, self-denying and probably covertly envious. Therefore, these are not they who are rich and we must look for the rich man elsewhere.

The question is, where are we to find him? Perhaps near at home. It certainly is not a fellow messmate whom I know to have a good wife, a moderate fortune, a good conscience, but unfortunately a bad digestion and a pessimistic outlook on life which makes him see so much vanity and weakness in all his fellow-creatures that he believes neither in them nor in himself. I often look at him across the table and say to myself, "poor beggar," and that about sums it up; he is not rich but really poor. I contrast him often with myself, by kindly Providence endowed with what he has lacked, a good digestion and a confident belief in myself and in the world. Dare I say, "Eureka"? for, if so, then surely it is a princely find

and the very basis of riches. To a great extent, yes, but not wholly so, because a mere mental outlook on the world will not in itself constitute riches. Many a man owns a good picture, but, unless he appreciate it, he does not possess it. So, as in regard to other and greater things, riches may give ownership, but without knowledge, experience and sympathy there is no real possession. The fact is no one can possess the whole world, but all can possess some one phase or aspect of it, and it is to those who have money and the leisure to use it that is given the ability to possess the world sympathetically and comprehendingly at many parts or in many phases. The danger is lest we forget that money can be used for good and useful purposes, and that too often the man who is greedy for money does not want to use it for such purposes. His greed has become abstract and is a greed for a mere symbol and forgetful of what the symbol implies. The conclusion, therefore, is that the mere possession of money, without a corresponding ability to appreciate and enjoy what that money can buy, does not make a man truly rich, and it follows from this that the man who devotes all his time to getting money has often no time left for getting rich.

VI.

With somewhat mixed feelings, I have just thrown down the daily paper. Its dominant theme was that industry, finance and the public services demand the leadership of the young. To me, as a man nearer 60 than 50, such a view suggests certain reflections. Doubtless, the cannibalistic propensities of modern industrial life have given rise in some quarters to the belief that the world's progress is dependent upon the number of funerals conducted for those who sit in high places. The explanation is that modern industry wears out brains in the office as speedily as it does hands in the workshops. The exigencies of the process hurry much good metal to the slag dump and our competition methods demand young men for the reckless driving. The same arguments or reasons operate in the public services, notably in the Army and the Navy, especially under conditions of modern war.

Inquiry into the question of "meridian" in the sphere of war gives 31 as the average age of such great commanders as Xenophon, Hannibal, Scipio, Pompey, Cæsar, Drake, Turenne, Blake, Eugene, Rodney, Columbus, Nelson, Napoleon and Wellington. But these are types of men seldom available after long years of peace, during which the profession of arms fails to attract ambitious young men with habits of industry. Hence, when a great war comes "out of the blue," we find the higher ranks filled by men representative of a leisured class, few of whom are fit to take up exhausting strenuous work. It follows that the first phases of such a war must be carried on by them, but gradually they cannot stand the pace, and are more profitably replaced by brilliant men of half their age. On the other hand, in literature and art some of the finest work has

been done by the old as by the young men. Take William de Morgan. Throughout a busy life other interests engaged his powers, but at 65 he began to turn out a marvellous series of books, starting with "Joseph Vance" and ending with "Ghost meets Ghost," written when he was well in the seventies. Similarly, Sidney Cooper reached the mature age of 99, and yet in our galleries are to be seen his wonderful paintings of sheep, done when he was 83. Likewise, the celebrated altar-piece picture, "SS. Jerome, Christopher, and Augustine" in a beautiful mountain landscape by Giovanni Bellini, and destroyed by the Austrians with the church of San Crisostomo in an air raid over Venice, was painted by the artist in 1513 when he was in his eighty-fifth year. But we need to be cautious how far we carry our generalizations. One is tempted to admit that industry seems to demand the lash, but the forces of social progress require light and gentle hands upon the reins. As we pass from our national immersion in the floods of industrialism or war activities to a wider vision of administrative or of social aims and ideals, we recognize that knowledge, character and experience have priority over raw strength and the purely acquisitive powers.

I am reminded here of a passage I read not long ago in Morley's Life of Gladstone. In the midst of the late Irish crisis, some one asked the old statesman whether he did not find it hard to give up the years which should be devoted to rest and leisure to such ardent service of his country. The reply was, "My vision is clearer and more inspiring than ever before. The burning enthusiasms of youth cannot be compared with the calm assurance which I now feel that the right must eventually triumph. It would be quite impossible for me to deny myself the ineffable joy of a part of the conflict." To me, that is a very remarkable and suggestive sentiment and but illustrative of the view that old age should bring to every one something more than mere leisure or peace of mind. It must be productive of actual results or peace will not be possible to a vital personality. The words of Browning seem apt:

"Grow old along with me
The best is yet to be,
The last of life, for which the first was made;
Our times are in His hand
Who saith, "A whole I planned,
Youth shows but half." "Trust God, see all nor be afraid."

Again, while the experienced among us can inspire, they cannot find new ways, yet who will deny to each ancient that the future always looms above the past? The heart-beats of the old and experienced are very present facts and factors in the world's evolution toward better things. Therein is the fundamental secret of a life worth living after one has been in the world for over fifty years; everything done in the past multiplies the effectiveness of each renewed effort. I have no doubt but that between

20 and 40 a man accumulates more goods and knowledge than he will acquire between 50 and 70, but when it comes to wielding a positive influence in the largest things, the later period is easily pre-eminent. In the heyday of youth we cannot help but waste a great deal of time experimenting. We try ten ways before we hit on the right road, and the world doubts us more than we doubt ourselves. Another factor making for the effectiveness of the older men is the great load of luggage which time has caused them to discard. The world of thirty is naturally the home and added to it that restricted sphere of effort which the support of home involves. It is the time for economic things, not philosophic and social problems. A man at 30 can rarely be really sure of anything beyond the fact that he is alive and at work. I am inclined to think that the experience of the thirties is not even comprehended in the fullest sense until after 50.

At forty one fights with men of forty, but at sixty one walks again with the lad of fifteen. This is no trait of senility but only the wisdom of sixty asserting its knowledge that the most satisfying of present experiences is companionship unharried, and free from the need to grind at the expense of the eternal verities. While age can fight as hard as youth, it can also enjoy more keenly the victories long deferred. It can appreciate the chances of a cause and feel even more deeply than those whose social philosophies must necessarily be untried of experiences. Therefore, though the times demand more of our young men, it is difficult to admit that the sphere of utility of the old men is removed. There is room for both, for the social consciousness expresses itself more completely through minds mellowed and tempered by long service, and the social hope anchors its grappling irons most seriously in hearts and minds tried by long service to ideals. Youth may be absorbed by and be better suited to the striving, but the heart of age appraises better the value of the results. The drama of life is too complex and its staging is too vast for the principal parts of its comedies and tragedies to be played by only one group of actors. Let us never forget that even though history is made by men, yet men are the products of history and experience.

VII.

Circumstances permit me to enjoy a short stay in Wiltshire and, in leisure hours, the primitive man within me asserts himself by impelling me to wander over the chalk hills and downs so characteristic of the district. With comforting pipe and lying in some sheltered spot, one can then forget all the arts and panoplies of man's war and contemplate the various phases of Nature's war as well as those of her peace. In truth, it all has a charm of its own. What fascinates me most is the wonderful great sea of green billowy hills, extending bare against the wide sky to the horizon, clothed with an elastic turf and, here and there, topped by a clump or grove of trees which is a sure and certain sign of more primitive times when the groves were God's first temples. It is no far-fetched simile, for I see before me now

a clump of trees most temple-like in form emphasized by a huge prehistoric earthwork, ring within ring, enclosing the grove on the space within.

As I pen these notes in the shade of such an hallowed grove on a hot and windless summer day, I see the air near the surface of a distant down appearing as a silvery mist wavering, dancing and producing an illusion of motion in all distant objects. Then, as I withdraw my eyes from the distance and look closer around me, the grove becomes as a small island of animal life dumped down on the ocean-like smooth green waste, all vacant as the sea. It is the sight of the wild life all about which refreshes more than the leafy shade, for without this life the grove would indeed be a melancholy place. The ear catches the crooning sound of doves and in the higher trees some wood-pigeons have their nests. On a thorn bush near by sits a magpie. A little farther off, a quaint family of owls sit side by side on a dead branch in the hollow of a furze-bush. As I watch them, the sun shows up their colouring and their long black narrow ears stand erect in astonishment, while five pairs of round orange-yellow eyes stare back at me. In a clearing, strut and chatter a small cluster of starlings, finches and linnets busy in search of food. Suddenly, the whole air of calm is gone, for across the clearing swoops a sparrow-hawk. Possibly, there is no more fascinating spectacle in wild life than the chase of its quarry by a hawk. Such sights are not common in these days, as the gamekeeper has extirpated ruthlessly all the more interesting specimens of bird life, especially the predatory birds, from our woods. What can be more depressing than a keeper's gibbet? where hang stoats, weasels, moles, crows and rooks, to say nothing of jays, magpies, kestrels and sparrow-hawks. Such a keeper's gibbet is decorated after the manner of a modern woman with wings and carcases of birds and heads and tails of little beasts, making the wood in which it stands a travesty of what it was meant to be, that is, at once Nature's playground, her school and example to man. Curse and degradation are written only too clearly on such places, and the pity of it all is that the writing is by the hand of man, Nature's greatest child.

It is sad to reflect that the groves and woods which form bird refuges or small sanctuaries for wild life are getting rarer every day. A few years of kindly toleration or love of birds on the owner's or tenant's part would serve to people a grove or wood with great Nature's happy commoners; but the newer fashion of sport has made those who had been and should now be the preservers of our country's wild life, its systematic destroyers. Our noblest species of birds are going or gone, such as the raven and buzzard, the goshawk, kite, peregrine, kestrel and sparrow-hawk; and in their place remain only the finches, sparrows and semi-domestic poultry such as pheasants and partridges. The gradual extinction of the soaring birds is all the more regrettable as they were and should be still a feature in our landscape, making it seem vaster, the clouds higher and the sky so much farther away. Indeed, they were something more; for the sight of them and the sound of their shrill cries completed and intensified the whole effect of Nature's wildness and majesty.

Alas! all seems changed now and it is rare to be able to find a wood, grove or copse truly peopled by normal bird life. To the natural man, the woods and their feathered inhabitants have another call. Like the ocean and the desert they revive a sense of which we are too often unconscious, but which is always with us; it is the sense which comes down to us from the time when the principal activities of our race were in woods and deserts. Given the right conditions it springs to renewed life and to me and many it is that which gives life's best savour, and not one to be replaced by the objects which civilized dwellers in towns have invented as substitutes. On the downs and in the groves we are able to forget the artificialities. In such moods and in these green shades, we are ready to echo every grateful word spoken of those who have preserved for us so much of Nature's freshness. Doubtless they did it for their own pleasure, but incidentally the good was for all. *Requiescat in pace.*

VIII.

At times, I have been twitted by my friends as being somewhat of a "solitary bird." Whether to take it as a reproof or not I do not know, but I do know this, that there come moments into the lives of all of us when we long to get away from everything and everybody, that is away from everyday life or the irritations of the trivial. When I was a boy, I knew an old man who was a shepherd. He was an oddity in his way but almost a chum of mine. He used to interest me not so much by what he told me as because of his taciturnity; he seemed ever to be watching, observing and thinking. I remember asking him once whether he was not dull. This he would not admit, and now, as I recall his grim rugged face and slow drawn speech, I realize that though he would tell me little about the truth of many things, yet he felt it. The clamouring of the crowd did not reach him, but thoughts came to him which were real individual thoughts, often quaintly expressed and in those days wasted on my unappreciative ear. Now, my view is that I am all the better for living the life of a shepherd occasionally, or even for a short time each day.

In claiming this privilege, I am actuated by no desire to be unsociable but rather to assert the principle that if you cannot get away from your surroundings from time to time, you can never get outside them, and so develop a sense of criticism. The desire for solitude is no modern symptom, for in ancient times there are said to have been as many anchorites in the deserts of Egypt as there were men in her cities, and in the Middle Ages we know that monachism was a fashionable cult. However, the craving for thoughts that bring light need not drive us into the waste places of the earth or to the hermit's cell. As against these devices for clearing up things in our minds, it may be affirmed that our capacity for thought is independent of environment, or that the only real necessity is a sufficient intensity of desire within ourselves. Given this

desire, the prosaic difficulty arises for the greater number of us that the moment we try to get away from our conventional duties or responsibilities and show signs of restiveness our friends and relations begin to comment. Even so, we cannot get away from the fact that we all need to retreat occasionally, to seek some quiet sanctuary far from the turmoil of life and the agitating society of our fellows. Some quiet place where all the world is sexless is necessary to every man if he does not wish to decay of too much animation. It has often struck me that the majority of people live far too much in view. Emerson, I think, has said that no man or woman is really his or her true self except when they are alone; and this is true because most things in this world have become a pretence and the moment we find ourselves in the company of others, we instinctively assume a mask. True, the mask which we put on may be sometimes more beautiful than the mood which lies behind it or conversely it may be more unkindly, yet still a mask is always a mask, and frequently none too comfortable to wear. Hence arises our longing to get away by ourselves. Apart from this, to be ever with others involves a constant emission of ideas which results ultimately in a sense of staleness or void. If we are ever talking we can never be thinking, and if we never think our heads become empty. The chance to fill that emptiness or need to restock our minds comes best and often only when we get alone by ourselves and are able to think things out. This explains why people who are always with other people, and are never happy unless they are with others, are so frequently dull.. These are the people who never realize that a too great propinquity, though it may breed love, will as surely kill it. Small talk may make an interesting letter but it is fatal to real reposeful friendship, and it is the small talk of our friends that lines the nest wherein so many "solitary birds" are hatched.

IX.

A small boy friend of mine celebrated recently his birthday. Among the gifts which that day brought him was a set of drawing instruments, and it happened that I devoted an hour to his amusement by helping him to draw geometric figures, for which he appeared to have a great liking. Circles and figures which included arcs or curves seemed especially fascinating to him. Whilst drawing these rings or circles for the child, certain thoughts presented themselves; true, they were thoughts which I could not develop to so young a lad, still they reasserted themselves in later hours of idleness and their theme takes the following form. Just as around every circle another can be drawn, so in nature and to our human efforts there is no end, for every end is a beginning and every action admits of being outdone. This fact, at once the inspiration and condemnation of every success, is the symbol of the unattainable, and finds its illustration in many phases of human life.

It has been well said that the key to every man is his thought, which

means that all his actions are orientated to or dominated by his soul or personal idea, and that he can only be changed by showing him an idea which commands his own. The personal idea is but the centre of a ring, and the whole life of man is a self-evolving circle expanding outwards to new and larger circles *ad infinitum*, and the extent to which this making of circle outside circle depends on the force of the individual soul. If we reflect a moment, we see that each apparent ultimate fact is but the first of a new series and that there is no circumference to us. A man makes his mark in his day but another arises and draws a circle outside the ring which but a short time before was regarded as the spherical limit. In this manner, the hero of to-day may be and often is the hot potato of to-morrow, and that the results and principles established or discovered and regarded in our time as the last word become in the next generation abridged into a phrase or merely quoted as one example of a bolder concept. From this it becomes apparent that we men but stage the world as prophecies of the next age, and that each one of us is not a workman in the world, but rather a suggestion of what he should be. It is like some mysterious ladder of which the steps are actions or results, each being judged by that which follows. We all know how we dislike new statements or ideas, but we soon get accustomed to them and gradually the objections dwindle before the revelations of the new hour. Even in our purely personal affairs it is the same; each of us supposes himself not to be fully understood and that he has a greater possibility, hence man's continual effort to raise himself. Yesterday my mind was a void, yet to-day I may be full of thoughts and in a mood of self-conceit put them on paper, but in a week or a month's time I may wonder how I came to write or think such banalities. It is all comparable to a vast ebb and flow, periodically heaping itself on a containing wall, there to solidify and hem itself in, then bursting over that boundary and expanding another stage only to create a fresh high wave which attempts again to stop and enclose.

I am reminded here of the old saying, "Tell me who are a man's friends and I will tell you what he is." This is but another way of formulating the axiom that a man's growth is seen in the successive circles of his friends, and that friends cease to interest us when we find their limitations. Think of the friends and loves of the past. Alluring and attractive they doubtless were, metaphorically a lake in which to swim, but gradually we found their limits and what seemed a lake became a puddle and we cherish no regrets that we got out of it and see those friends no more. The metaphor holds good in respect of the higher things because each new step in thought reconciles many apparently discordant facts as expressions of one law. Even our virtues are not final, for the virtues of society are vices of the saint, and our faults or sins may be the living stones out of which we shall construct the temple of God. All our hopes, thoughts, religion and morals are at the mercy of some new generalization because our instinct presses ever onward to the impersonal

and illimitable, and extinguishes each virtue in the light of a better. Similarly, if we look at the natural world we can conceive it as a system of concentric rings and presenting a condition which is never stable but ever moving onward. And yet this incessant movement and progressive generation of ever widening circles involves the recognition of some principle of stability at the centre and within us. What that is, it is hard to say, but it evidently is something which contains and impels all its enlarging rings or circles, and by virtue of that is superior to knowledge and thought. Its labour seems in vain, for that which is made suggests ever how to make a better. So it goes on, and there remains only for us to forget ourselves and to do something without knowing how or why; in fact, to draw a new circle outside that in which we happen to be. Never ending, still beginning.

EXPERIMENTS CONCERNING THE EFFICIENCY OF HOT-AIR HUTS FOR THE DISINFESTATION OF BLANKETS AND CLOTHING.

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With Plans of an Improved Pattern of Hot-air Hut and Chart showing graphically the Experimental Results.

Introductory Note.

The research with which this paper deals was the outcome of instructions received by Captain Grant from the Deputy Director of Medical Services of the Eastern Command to carry out a series of experimental tests in the Hot-air Hut established at Moore Barracks Hospital, Shorncliffe, Kent, with a view to settling the following questions:—

(*a*) The temperature necessary for the destruction of lice and nits under practical conditions of a fully loaded hut.

(*b*) The effect of the temperature necessary for this purpose on bacteria.

(*c*) The most suitable temperature to maintain with a view to: (1) Maximum lethal results; (2) avoidance of damage to the articles treated; (3) and economy of fuel.

(*d*) The possibility of improvements in the construction and methods of working.

During a consultation with Mr. Bacot, at the Lister Institute, concerning ways and means, the experiments necessary for the solving of these questions were discussed and the main lines of the procedure were arranged; Mr. Bacot undertaking to supply and dispatch from London the batches of lice and nits as required in readiness for exposure in the hot-air hut at Shorncliffe, and further to carry out the necessary examinations after exposure, and to incubate the nits, the control and manipulation of the hut and bacterial work devolving entirely upon Captain Grant.

In considering the results of these experiments it must be borne in mind that the conditions imposed on us by the use of an existing hut of admittedly imperfect character prevent the exactness and definiteness which are possible under laboratory conditions, where the apparatus is, owing to the gradual improvement on the part of generations of workers, capable of extreme exactitude. On the other hand it is to be noted that these experiments were carried out under the practical conditions of a fully loaded hut, and at the same time they were based on the exact observation (we think for the first time) of a very large amount of material. The number of active lice used for experiments and control was at least 700, while the nits used numbered anything between 3,000 and 8,000.

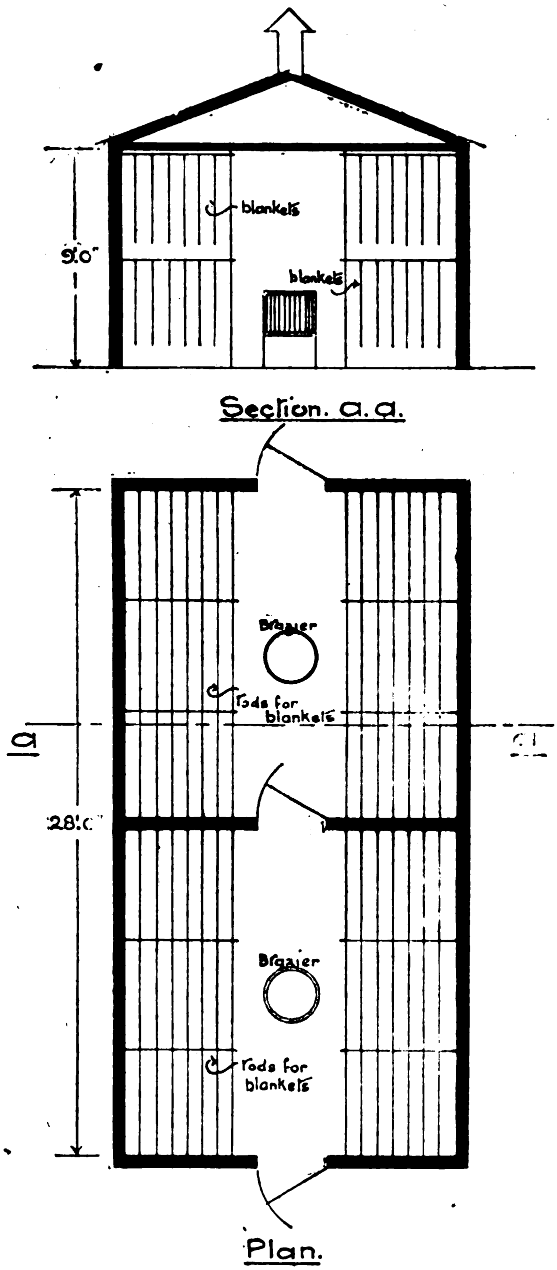
Description of Hut. (Plan 1.)

The hut at Moore Barracks Hospital, Shorncliffe, designed by the officer commanding Canadian Sanitary Section, stationed there, had been constructed for the purpose of disinfesting blankets and kits by means of hot air generated by an open coke brazier in each half of the hut. The dimensions of the complete hut are: Length, 28 feet; width, 14 feet; height of flat ceiling inside, 9 feet.

The sides and roof are made of galvanized iron, the floor of concrete; the walls and ceiling are lined with uralite. It stands in a very exposed position, and the weather during the first six experiments was wintry.

The hut is divided into two equal halves by a cross partition of wood, covered on each side with uralite. In the centre of the partition is a door; the dimensions of each half-hut are, therefore, 14 feet long, 14 feet wide, 9 feet high; cubic feet, 1,764. In the centre of the floor of each half-hut is the open mouth of a four-inch pipe, the other end of which is in the open air at the side of the hut, a few inches above the ground. The size of this external opening may be regulated by a damper. In the centre of the flat ceiling of each half-hut is a trap door which is opened or closed by means of a rope and pulley worked from outside, close to the door. On top of the sloping roof is a louvred ventilator. There were two braziers with legs eighteen inches long, one for each half-hut; these can of course be used simultaneously in each half-hut, but the chief object of the double arrangement is to permit unloading and loading in one half during the period of disinfestation in the other half.

Let into the door was a glass panel through which the temperature, as recorded by a thermometer whose bulb was three feet from the floor, could be read. So far as we are aware, the correctness of the readings of this thermometer as recording the temperature available for the destruction of lice and nits in blankets and uniforms under Army conditions, in all parts of the hut, had never been called in question. Our suspicions of the accuracy of this method of arriving at the internal heat of the chamber were aroused, from description, before we had actually seen the hut. We



PLAN 1.—Hot-air hut at Moore Barracks Hospital, as originally designed. (Drawn by Sergt. F. G. Grierson, R.A.M. College.)

therefore made use of several maximum thermometers with the result that our suspicions were fully justified, as will be seen from a study of the earlier experiments. After alterations initiated by Captain Grant in regard to the lowering of the brazier to within two inches of the cold-air inlet, the lowering of the level of the latter, and the placing of a second thermometer, four inches above the floor, it was possible to use the hut with some assurance with regard to results. Apparently no critical tests previous to ours had been made, or these defects would hardly have escaped notice.

Capacity of Hut.

The capacity of a hot-air hut depends not alone on its cubic capacity, but also upon the arrangement of the tiers of bars or rods upon which the clothes or blankets are hung. The load depends on the number and length of rods. Each rod, measuring 4 feet 8 inches, takes 5 blankets; the number of rods in a half-hut is 60, and so the number of blankets in a half-hut of above dimensions is 300. The blankets are arranged on one-inch iron rods in two tiers. Each blanket, being folded lengthwise, is thrown single-thickness over the rod and pushed along from one end, so that it becomes more or less puckered. By means of slideable hooks or coat-hangers, about 100 kits, including greatcoats, can be disinfested at one time; tunics and trousers are turned inside out.

Periods Required to Load, Unload and Ventilate.

The time required by two men to load each chamber of the hut to its full capacity (i.e., 300 blankets) is twenty to thirty minutes. Unloading can be accomplished by two men in twenty minutes. The time required to ventilate and get rid of the dangerous carbon monoxide, after removal of the brazier, is five minutes, but this time may be reduced if all the doors in a hut be opened at once.

Amount of Fuel needed and Period required to attain the Lethal Temperature.

The amount of coke required in the brazier for the first batch of infested material is 40 pounds, for the second batch 20 pounds are added to the coke remaining in the brazier, for the third batch 20 pounds are added to the coke remaining in the brazier, and so on.

The time required to attain a door temperature of 65° C., with the thermometer bulb four inches from the floor, after placing the glowing brazier in the cold hut for the first load of the day, is sixty minutes at least; but for the second and subsequent loads about thirty minutes suffice.

Experimental Methods.

Lice and Nits.

As noted in the introduction, the batches of lice and nits used in the experiments were forwarded from the Lister Institute and returned thence after exposure. The time elapsing between dispatch and exposure was

seventeen to eighteen hours; the period between exposure and examination being as a rule about twenty to twenty-two hours. The active lice were fed immediately prior to dispatch, and, judging by the state of the alimentary canal of the controls on return, this meal was amply sufficient for forty-five to fifty hours under the temperature conditions during the two journeys. In Experiments I to VII, five boxes containing active lice, as well as nits, and five pockets containing nits were used; in Experiments VIII to X, pockets of nits only were exposed. The boxes used were ¾-inch in diameter, of the usual entomological pattern, with glass bottom and card sides. A ring of Army shirt flannel was placed in each box to give the insects foothold, the nits being laid on a similar slip, while the open top was covered with fine gauze. Each box contained at least 20 active lice and from 50 to 100 nits. The pockets measured 2½ inches by 1½ inches, and were made by folding a slip of khaki cloth and stitching the sides, a strip of flannel on which 50 to 100 nits had been laid being placed in each pocket; the aim being to reproduce the conditions of nits laid in the seams of clothing. In every case four only of the boxes or pockets were exposed, the fifth being utilized as a control. On exposure the lid of the box was removed, so that the top was open, save for the gauze cover. The khaki pockets were pinned on either blankets or clothing, and the boxes stood upon the glass bottom with the gauze covered top above. On their return the contents of each box or pocket was carefully examined under a binocular dissecting microscope and those nits which were not obviously destroyed were kept in separate boxes and incubated with the controls in a bag suspended from the neck, between skin and shirt.

Bacteria (Experiments I to V only).

The cultures of *Bacillus typhosus*, *Staphylococcus aureus* and *B. coli* were obtained from the Royal Army Medical College. About half to one hour before exposure, a loopful of a twenty-four hour culture grown at 37° C. was spread on a piece of sterile khaki ½-inch square enclosed in a sterile petri dish. After exposure, the piece of khaki was transferred to a tube of bouillon and incubated at 37° C. for forty-eight hours. As a rule the lids were on the Petri dishes; sometimes duplicate open dishes were used as well, but with the same results as in the closed Petris.

In every case the hut was fully loaded with blankets and clothing when the experiments were conducted.

Temperatures.

The temperatures necessary for the destruction of lice and nits in laboratory tests are recorded by Bacot (1916) to be 54° C.; Haymann (1915) 65° C.; Kinloch (1915) 65° C.; Nuttall (1917) 60° C.; it was therefore decided to commence by verifying these temperatures under practical conditions. A maximum thermometer was placed with each of the four lots of lice, nits and bacteria exposed in the position noted in the protocols.

The accuracy of these thermometers was carefully tested before use. All four were placed in an incubator running at 37·6° C., and all recorded that temperature. They were then, with two of the routine laboratory thermometers, placed in beakers of water of various temperatures, and again found to be in unison.

The half-hut, having been loaded and the trial pockets of lice, nits, bacteria and maximum thermometer having been placed in position, the glowing brazier, which had been kindled about an hour beforehand, was carried in and placed over the cold air inlet and a sheet of iron placed over it to lessen the danger of fire, and throw the heat downwards. The door was then closed and a watch set on the door thermometer, the period of exposure being counted from the moment when the predetermined temperature was reached.

The Experimental Evidence.

The first three experiments, as regards the boxes and pockets containing the lice and nits, were simple exposures, but the bacteria received more or less protection from the heat by placing the treated slips of khaki in folds of blanket or in the pockets of tunics. In later experiments both the lice and nits were sometimes similarly protected; in one instance (Experiment IV) by as many as four folds of blanket, and in another instance (Experiment VI) by the fabric of wet garments.

EXPERIMENT I.—Tuesday, April 3, 1917. Temperature, as Recorded by Door Thermometer, 140° F. (60° C.) for Fifteen Minutes.

No. of test	Position	Maximum temperature in C.	Results on				
			Lice	Nits	*B. typhosus*	*S. aureus*	*B. coli*
1	Middle of floor of west side of hut on a board ¼ in. thick, 5 ft. 4 in. from brazier	37°	Not killed	Not killed	Not killed	Not killed	Not killed
2	Lice on board laid on second tier, 5 ft. from floor, south-west corner 1 ft. from wall. Infested khaki pinned within blankets at same place	67°	Killed	Killed	Killed	Not killed	Not killed
3	Lice on board on first tier 2 ft. 6 in. from floor, north-east corner 1 ft. from wall. Infested khaki in blanket	53°	Killed	Not killed	Not killed	Not killed	Not killed
4	Lice on board on third tier 6 ft. 10 in. from floor, south-east corner, 1 ft. from wall. Infested khaki in tunic pocket	103°	Killed	Killed	Not killed	Not killed	Plate broken
5	Control lice and nits kept at room temperature. Lice active on examination; nits hatched normally after incubation.						

Remarks.—The general working thermometer was placed 2 or 3 inches behind the back of the door, to which it was fixed by a wooden case, the bulb being 2 feet 3 inches from floor, and the index readable through a glass window.

EXPERIMENT II.—FRIDAY, APRIL 6, 1917. TEMPERATURE, DOOR THERMOMETER, 52° C FOR THIRTY MINUTES.

No. of test	Position	Maximum tempera- ture in C.	Results on				
			Lice	Nits	*B. typhosus*	*S. aureus*	*B. coli*
6	17 ft. from floor in middle of west side	55°	Killed	Killed	Not killed	Not killed	Not killed
7	Same as Test 2	90°	Killed	Killed	Not killed	Not killed	Not killed
8	Same as Test 3	68°	Killed	Killed	Not killed	Not killed	Not killed
9	Same as Test 4	106°	Killed	Killed	Not killed	Not killed	Killed
10	Control lice and nits kept at room temperature. Lice, two dead out of fifteen; nits hatched normally.						

EXPERIMENT III.—THURSDAY, APRIL 12, 1917. TEMPERATURE, DOOR THERMOMETER, 60° FOR ONE HOUR.

No. of test	Position	Maximum tempera- ture in C.	Results on				
			Lice	Nits	*B. typhosus*	*S. aureus*	*B. coli*
11	Same as Test 6	48°	Not killed	Not killed	Not killed	Not killed	Not killed
12	Same as Test 7	84°	Killed	Killed	Not killed	Not killed	Not killed
13	Same as Test 8	60°	Killed	Killed	Killed	Not killed	Not killed
14	Same as Test 9	102°	Killed	Killed	Killed	Not killed	Not killed
15	Control lice and nits kept at room temperature. Lice all active on examination; nits hatched normally.						

Remarks.—After Experiment II the legs of the brazier were shortened so that the bottom of the brazier was only one foot from the floor.

The typhoid khaki was exposed to the hot air in duplicate, viz., in closed and in open Petri dishes, without any difference in result. Control plates containing non-infected khaki gave sterile results, showing that the sterilization of the khaki-containing Petris was efficient.

EXPERIMENT IV.—APRIL 17, 1917. TEMPERATURE AS RECORDED BY DOOR THERMOMETER, BULB FOUR INCHES FROM FLOOR, 60° C. FOR THIRTY MINUTES.

No. of test	Position	Maximum temperature in C.	Results on				
			Lice	Nits	*B. typhosus*	*S. aureus*	*B. coli*
16	Lice and Petris as in Tests 6 and 11; nits in pocket laid on four thicknesses of blanket and covered with four thicknesses of blanket, close to the lice and petris	68°	Killed	Killed	Not killed	Not killed	Not killed
17	Lice boxes and Petris as in Tests 2, 7, and 12; nits in pocket enclosed in blankets as in Test 16	96°	Killed	Killed	Accidentally destroyed	Accidentally destroyed	Accidentally destroyed
18	Lice boxes and Petris as in Tests 8 and 13; nits in pocket enclosed in blankets as in Tests 16 and 17	78°	Killed	Killed	Not killed	Not killed	Not killed
19	Lice boxes and Petris as in Tests 4, 9, and 14; nits in pocket enclosed in blankets as in Tests 16, 17, and 18	120°	Killed	Killed	Not killed	Not killed	Not killed
20	Control lice and nits kept at room temperature. Lice all active on examination; nits hatched normally						

Remarks.—The maximum thermometer was laid beside the lice boxes; there was no thermometer actually beside the nit pockets, i.e., within the blankets. *The brazier legs are now only 4 inches high, i.e., 8 inches shorter than in Experiment III; the cold air inlet beneath the brazier is now only 2 inches high, thus leaving an air space of only 2 inches between bottom of brazier and air inlet.* The comparatively high temperature of 68° C. obtained 18 inches from the floor (in extremely cold, snowy weather) is almost certainly due to the much lower position of the brazier. It is essential to place the bulb of the door thermometer a few inches from the floor, for if the temperature in the lowest air stratum is effective in killing that in the upper strata is more than effective.

EXPERIMENT V.—APRIL 20, 1917. DOOR THERMOMETER 60° C. FOR FIFTEEN MINUTES, BULB FOUR INCHES FROM FLOOR.

No. of test	Position	Maximum temperature in C.	Results on				
			Lice	Nits	*B. typhosus*	*S. aureus*	*B. coli*
21	9 in. from floor, 4 ft. 6 in. from brazier	31°	Not all killed	Not killed	Not killed	Not killed	Not killed
22	Second tier as in Test 2	51·5°	Killed	Not killed	Not killed	Not killed	Not killed
23	First tier as in Test 3, but 3 ft. 6 in. from brazier	46°	Some killed; most survived	Not killed	Not killed	Not killed	Not killed
24	Third tier as in Test 4	51·6°	Killed	Killed in pocket, but not in box	Not killed	Not killed	Not killed
25	Control lice and nits kept at room temperature. Lice all active on examination; nits hatched normally						

Results.—The open lice boxes, the nit pockets, the maximum thermometers, and the Petris were laid on four thicknesses of blanket and covered with four thicknesses of blanket. After placing the glowing brazier in position thirty-five minutes elapsed before the thermometer reached 60° C. A maximum thermometer laid on the floor 4 feet 2 inches from brazier, exposed to the hot air and unprotected by blankets, recorded 32° C.

EXPERIMENT VI.—April 24, 1917. Door Thermometer 60° C. for Thirty Minutes, Bulb Four inches from Floor.

No. of test	Position	Maximum temperature in C.	Results on Lice	Results on Nits
26	Inside fork of *dry* khaki trousers, 1 ft. from ground, and 3 ft. 9 in. from brazier	55°	Killed	Killed
27	In armpit of *wet* khaki tunic; 1 ft. from ground, and 3 ft. 9 in. from brazier	57°	Killed	Killed
28	Inside fork of *wet* khaki trousers, 4 ft. from ground, and 3 ft. 6 in. from brazier	55°	Killed	Killed
29	In puckered fold of *dry* blanket 4 ft. from ground, and 3 ft. 6 in. from brazier	73°	Killed	Killed
30	Control lice and nits kept at room temperature. Lice all active on examination; nits hatched normally			

Remarks.—In the two wet tests, 27 and 28, the tunic and the trousers were immersed in a pailful of water and wrung out so as to correspond to a good soaking with rain; the nit-containing pocket was also soaked in water; along with the unlidded lice box, and the thermometer bulb, it was placed in a wetted thin gauze bag, three inches square, which was pinned into the position indicated. In the two dry tests, 26 and 29, the nit-containing pocket, together with the unlidded lice box and the thermometer bulb, was placed in gauze bag which was pinned into position indicated.

EXPERIMENT VII.—April 27, 1917. Door Temperature 60° C. for Sixty Minutes.

No. of test	Position	Maximum temperature in C.	Results on Lice	Results on Nits
31	Nit pocket pinned inside fork of *dry* trousers; lice box in pocket; other details as in Test 26	64°	Killed	Killed
32	Nit pocket pinned in the farthest recess of inside fold of *wet* kilt; lice box inside it; other details as in Test 27	60°	Killed	Killed
33	Nit pocket and lice box in fork of *wet* trousers; other details as in Test 28	55°	Killed	Killed
34	Nits and lice in armpit of *dry* tunic, 1 in. from floor, 4 ft. from brazier	43°	None killed	Number hatched
35	Control lice and nits kept at room temperature. Lice all living when examined; nits hatched normally.			

Remarks.—Experiments VI and VII differ in *time of exposure*, and are therefore to be carefully compared; Test 26 with 31, 27 with 32, 28 with 33. Test 34 was substituted in place of a repetition of 29. The maximum thermometers were placed with bulbs close to lice and nits. The kilt straps were not perished.

EXPERIMENT VIII.—MAY 1, 1917. SIXTY MINUTES AT 60° C., AS RECORDED BY DOOR THERMOMETER.

No. of test	Position	Maximum temperature in C.	Results on nits
36	Nit pocket pinned within fold of *dry* kilt, lower edge 10 in. from floor, 3 ft. from brazier; thermometer bulb 4 in. lower	80°	Killed
37	*Wet* tunic; wetted nit pockets in armpit, 5 ft. from floor; thermometer bulb and nits on the same level	61°	Killed
38	*Wet* trousers; wetted nit pockets in fork, 2½ ft. from ground	56°	Killed
39	*Dry* trousers; nits in fork, 7 ft. from ground	108°	Killed
40	Control nits kept at room temperature; hatched normally after incubation		

Remarks.—After sixty minutes at 60° C., the nit-pockets on the dry things (36 and 39) were removed from the hut. The nit-pockets (37 and 38) remained attached to the wet garments while these, in order to dry them, were exposed for another twenty-five minutes at 60° C. plus the thirty minutes required to regain this temperature after opening the hut.

EXPERIMENT IX.—MAY 4, 1917. THIRTY MINUTES AT 65° C. (THERMOMETER FOUR INCHES FROM GROUND).

No. of test	Position	Maximum temperature in C.	Results on nits
41	Fork of trousers *on floor* 5 ft. from brazier	31°	Not killed
42	Fork of trousers 1 ft. above floor; 4 ft. 8 in. from brazier, separated by two hangings of blankets	70°	Killed
43	Armpit of tunic 2 ft. from floor, behind 3 hangings; 5 ft. 6 in. from brazier	84°	Killed
44	Kilt 3 ft. from ground, behind two hangings, 6 ft. from brazier	73°	Killed
45	Control nits kept at room temperature; hatched normally after incubation		

Remarks.—Two thermometers were placed behind door; bulb of one 4 inches from floor, of the other 2 feet 6 inches from floor. The fire was a very good one, just approaching its best, carried in at 10.20; in twenty-five minutes, i.e., 10.45, the low thermometer was 50°, the upper 60°; in forty-five minutes, i.e., 11.5, the low thermometer was 60°, the upper 70°; in eighty minutes, i.e., 11.40, the low thermometer was 65°, the upper 74; in ninty-five minutes, i.e., 11.55, the low thermometer was still 65°, the upper 80°.

EXPERIMENT X.—MAY 11, 1917. DOOR THERMOMETER 65° C. FOR TWENTY MINUTES.

No. of test	Position	Maximum temperature in C.	Results on	
			Nits	Leather
46	Fork of trousers, 1 ft. from ground, 4 ft. from brazier, behind screen of two hangings of blankets	61°	Killed	Not injured
47	Fold of kilt, 6 in. from floor behind two hangings, 4 ft. 9 in. from brazier	56°	Killed	Not injured
48	Fork of trousers, 6 ft. 8 in. from brazier, 18 in. from ground, behind one hanging	58°	Killed	Not injured
49	In armpit of tunic, 2 ft. from ground, behind two hangings, 5 ft. 6 in. from brazier	63°	Killed	Not injured
50	Control nits kept at room temperature; normally hatched after incubation			

Remarks.—At 10.25 two door thermometers were placed in position, the bulb of the upper 2 feet 6 inches from floor, of lower at 4 inches. A glowing brazier just approaching its best, containing the usual 40 pounds of coke, was placed in hut. The readings were: At 10.25 the lower thermometer was 30°, the upper 32°; at 10.55 the lower thermometer was 58°, the upper 58°; at 11.35 the lower thermometer was 65°, the upper 68°; at 11.55 the lower thermometer was 65°, the upper 73°. The door was opened several times during the last fifteen minutes to prevent temperature rising over 65° C. After ventilating hut, removing brazier, adding 10 pounds coke and replacing brazier, it took only thirty minutes to again reach 65° C.

REMARKS CONCERNING THE EFFECT ON LICE AND NITS.

The effects of the exposure on the lice and nits fall into two categories: (1) in which the effects are optically visible with a magnification of about ten diameters; and (2) in which there were no immediate visible signs of the cause of death of the active lice, and it was necessary to incubate the eggs in order to test if they were killed or not.

The line of demarcation corresponds roughly with thirty minutes' exposure to a temperature below or above 60° C. It was quite possible to decide with accuracy after examination and before advices respecting the exposure came to hand whether the temperature had been above or below this point. If above, the nits were collapsed or shrivelled, and the bodies of the lice were dried up, discoloured, or brittle, according to the extent of the rise above 60° C. If below, the lice would be soft, and not much, if at all, discoloured, while the appearance of the nits would be unchanged.

An outstanding feature of the action of heat on nits is the very narrow range of its variable action. Only in one instance was there any evidence of partial action, and in this case the recorded temperature, 51·5° C., killed all but two or three nits out of over fifty exposed.

Effect on Clothing and Blankets.—No injury to any of the dry textiles or dry leather took place during the course of these tests.

It will be seen (1) that the records of the uncovered maximum thermo-

meters show clearly the stratified condition of the air in regard to temperature and the need for some efficient means of equalizing the temperature throughout the hut. (In regard to this, see the Notes on this subject under the heading of Recommendations on p. 455).

(2) The effect of shortening the legs of the brazier indicates that the nearer to the floor level the source of heat is situated, the higher the temperature of the lower air strata, and the more quickly lethal temperature at this level will be attained.

(3) The use of a door thermometer affords no guide to the exact conditions of temperature throughout the hut. If, however, the door thermometer is placed at so low a level (say four inches), as to be beneath any garment that is in process of disinfestation, its record of a lethal temperature for the necessary period of time may be generally taken as sound evidence of disinfestation.

(4) That the minimum temperature recorded by the maximum thermometer as killing the nits was 51° C. (Experiment V, Test No. 24), with the door thermometer standing at 60° C. for fifteen minutes. As, however, in this test, the box of lice, pockets of nits, and maximum thermometer, were protected by four thicknesses of blankets, while in another experiment (Experiment I, Test No. 3), without any protection, the nits were not killed at 53° C., there is a discrepancy which requires explanation. Most probably Test No. 24, as recorded, is misleading, owing to an unequal penetration of heat throughout the fourfold covering of blanket to the maximum thermometer on the one hand, and the nits on the other. That this may be the explanation seems quite possible, as, judging by analogy with Tests 9 and 19, the temperature outside the protecting blankets would be over 100° C.

Apart from this doubtful record of Test No. 24 in Experiment V, the minimum heat and periods proved to be efficient for disinfestation were 56° C. for twenty minutes (Experiment X, Test No. 47), and 55° C. for thirty minutes (Experiment VI, Tests Nos. 26 and 28). In Test No. 47 the nits were not only protected by the khaki cloth of which the pocket containing them was constructed, but were further protected in the folds of a kilt; while the pockets of nits, in the cases of Nos. 26 and 28, were placed in the fork of a pair of trousers, which, in No. 28, had been previously wetted.

(5) That although the evidence is not exact with regard to the times for which these temperatures were maintained it is probable that they would be less, rather than greater, than the periods for which the door thermometer was maintained at 65° C. in the case of Experiment X, and at 60° C. in the case of Nos. 26 and 28.

(6) That mixed wet and dry garments should not be treated in the same load, as there is not only the danger of nits in wet garments escaping destruction, but, if there are many wet garments, of their reducing the temperature to which dry garments in their proximity are also exposed.

(7) That garments or blankets should not be either bundled or folded

closely together, nor must they on any account be hung so low that any portion of them comes within a foot of the floor or the level of the door thermometer when this is above floor level.

(8) That the bacteria tested were not killed by the temperature indicated in the charts. Tests Nos. 2, 9, and 13 were exceptions to this rule in so far that "no growth" occurred in the bouillon used to test sterility; in view of the very numerous positive results, it is doubtful if these negative cases can be regarded except in the light of freaks.

Recommendations and Suggested Improvements.

(1) *Working Temperature.*—While the experiments show that 55° C. is amply sufficient to destroy both lice and nits, even when protected by more than one thickness of khaki cloth, it must be borne in mind that this temperature was recorded by a maximum thermometer placed in close proximity to the nits and that *the door thermometer* registered 60° C. during the course of the trial. As in practice it is the door thermometer which must be relied upon for evidence of exposure, it is necessary that the safety margin of temperature be fixed in relation to this. In fixing 65° C. for thirty minutes as the door thermometer level in a hut such as the one experimented with at Shorncliffe, a very ample margin for contingencies, such as undue folding, overlapping, over-crowding, damp garments and faulty attention, has been allowed. In huts or heating chambers in which the recommendations and suggested improvements here set forth are adopted it will be quite possible to reduce this margin very considerably, with a corresponding saving in fuel without any danger to its efficiency. A thoroughly well constructed and efficiently worked hot chamber ought to be able to run with perfect safety at 55° C.

(2) The equalization of temperature throughout a hut or hut chamber is of great importance if efficiency and economy in working are considered. Further, upon it depends the absence of damage to fabrics and leather by overheating, and in greater measure freedom from fires which may be caused by collections of fluff in a ventilator being set alight. An electric or other mechanically driven, or even hand-driven fan, would seem to promise most success in this direction. Its installation should soon pay for itself out of economies in fuel and speed of working, as the period before the desired temperature is attained at the lower levels would be shorter, owing to the excess of heat which is wasted at the higher strata being available in proximity to the floor.

(3) In the door should be a plate glass window opposite the thermometer index. This window should be readily openable as condensation of moisture may render the scale illegible; the bulb of the thermometer, unless there be a trustworthy means of equalizing the temperature, being not more than four inches from the floor.

(4) That bars or wires should be arranged at right angles to the length

of the hut. In the Moore Barracks hut they are unfortunately parallel with the length of the hut, so that the blankets on the bars nearest the brazier act as screens or heat-barriers to those nearer the wall.

(5) *Wet*, as distinguished from *damp*, garments or blankets, must be either dried before treatment, or the exposure period must be increased according to the load, probably an hour at 65° C. would be sufficient, but the point has not been tested with a full load of soaked clothing or blankets. The safe guide is that, if clothing or blankets are dry when they come out, after exposure to this temperature, they will also be disinfested.

(6) Blankets and clothing must not be folded or bundled or closely pressed together. Blankets ought not to come within a foot of the floor; this is especially necessary in the case of a concrete floor without a non-conducting air-space underneath, or a wooden flooring above, for in the experiments lice and nits on and within a few inches of the concrete floor always survived.

(7) The temperatures necessary for the destruction of insect vermin and bacteria are shown to be of so different an order that it is well to clearly separate the idea of disinfestation from that of disinfection. The latter should never be attempted as an adjunct to the destruction of lice. When it is of importance for blankets or clothing to be disinfected it should be considered as a separate problem. In such cases the presence of insect vermin may be as a general rule ignored, as the means employed (for instance, steam) to disinfect will necessarily disinfest also, with the exception of formalin vapour below 55° C., and Clayton gas in respect of a small percentage of the nits.

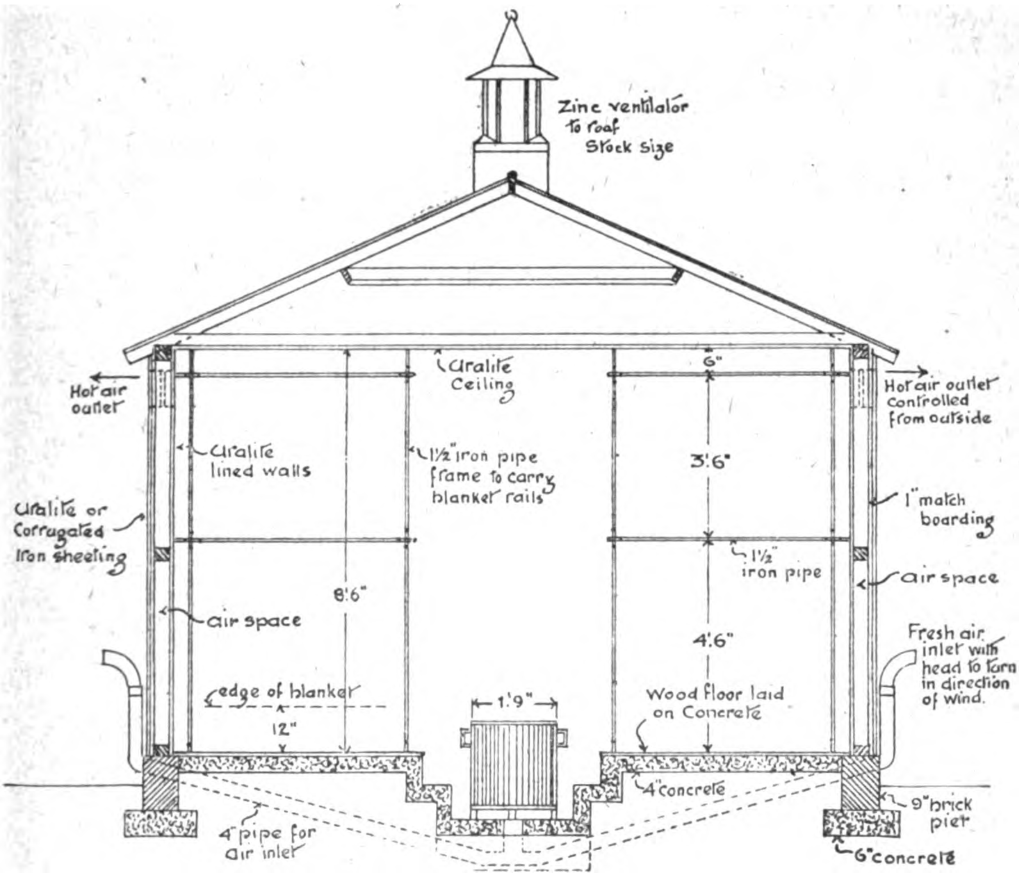
(8) The blankets or garments after treatment should never be thrown or dropped on to the floor of the hut, as this will probably harbour living lice which have dropped off the infested articles; the regular washing of the floor of disinfesting huts or transport wagons with a two per cent solution of cresol soap emulsion or lysol is necessary. An alternative method would be to sprinkle or dust them with powdered naphthalene before each day's work. For this purpose the cheapest kind of crude naphthalene available would serve; about twelve grammes, say ½ ounce per square yard being required.

(9) Those who handle infested and disinfested material ought to wear different overalls with hoods for loading infested and for unloading disinfested material, and infested and disinfested things ought not to be stored in the same spot.

(10) Attention to the service of loading and unloading is very necessary, as otherwise a certain number of cases may occur in which clothing or blankets have apparently escaped sterilization, whereas they have been reinfested when being unloaded by men who have temporarily infested themselves whilst loading the hut.

Suggestions for an Improved Hot-air Hut. (Plans 2, 3 and 4.)

In view of the difficulties and the unsatisfactory points referred to, the following improvements and alterations are suggested in the arrangement of fittings and construction of new permanent hot-air disinfestation huts (see plans on pp. 457, 458 and 459).

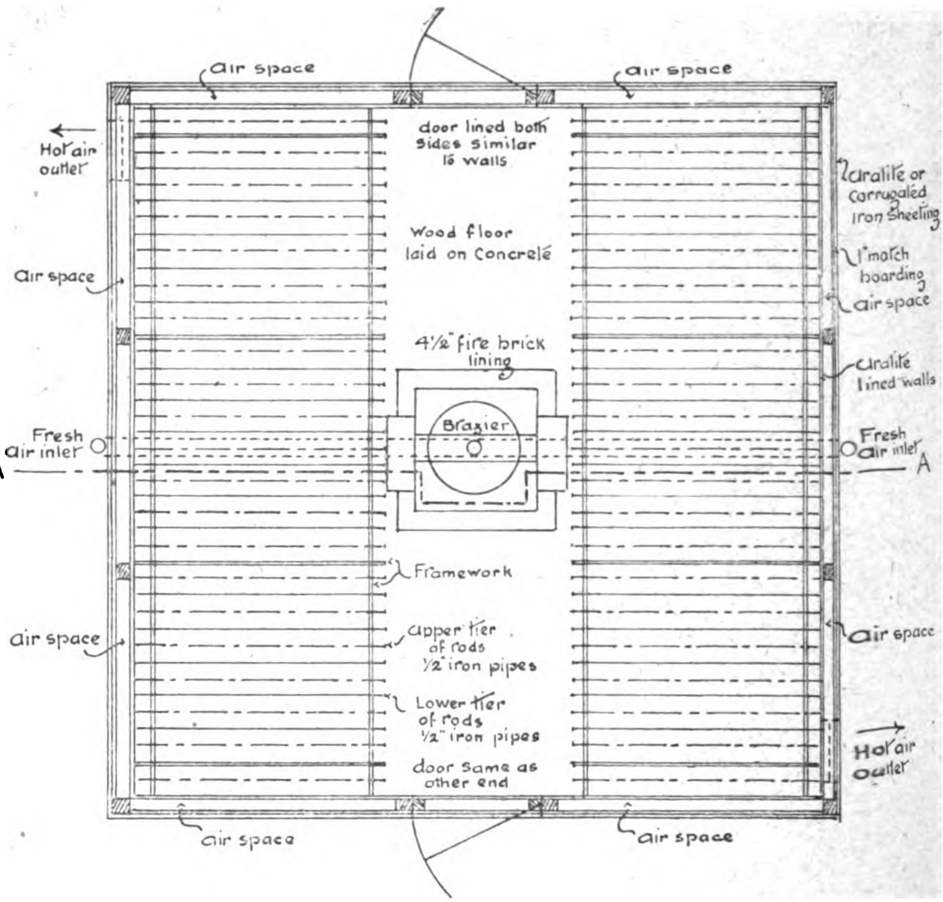


Plan 2.—Section A.A.

(1) Dimensions of a single[1] (not a double) hut should be fifteen feet square, and eight feet six inches from floor to ceiling. There should be two doors, opposite one another, one for the entrance of infested material and

[1] As already stated, the hut at Shorncliffe is a double hut, the original idea being that, while disinfestation was proceeding in one half-hut, the other was being unloaded and loaded. But such simultaneous working of both half-huts was not practised, because (*a*) the simultaneous use of both prevents quick through ventilation (by opening the partition door) of any of them, and (*b*) a second fatigue party of seven men, and more storage

the other for the exit of disinfested material; also for rapid through ventilation; each should lead to a receiving or dispatching station or room. The floor should, in order to conserve heat in the hut, be a non-conductor, e.g., of concrete constructed on sleeper walls, with an air-space; or of coke brieze concrete covered by ¾-inch flooring, and



PLAN 3.—Ground plan.

this again opposite the door (or doors) used for the brazier by a sheet of iron. A hut so constructed would heat more rapidly with a smaller consumption of fuel, and would not lose heat so readily.

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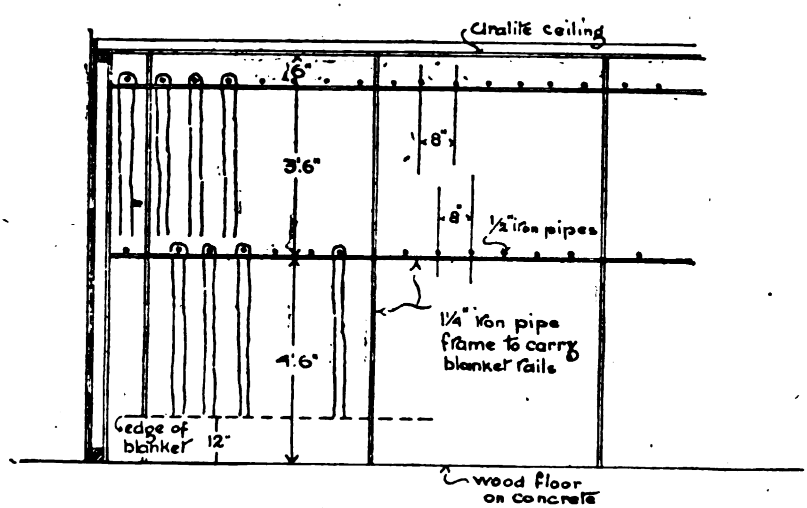
room, are required, and this excess of men and material within a restricted area leads to confusion both of men and material, and retards smooth working. Besides, in the majority of units on Home Service, a single hut which will disinfest 1,500 blankets a day in five loads, is doing all that is required. By working two shifts within twenty-four hours twice this number can be disinfested.

(2) The walls may be constructed of 3-inch by 2-inch timbers with uralite sheets, or other fire-proof, non-conducting material, each side, or with uralite inside and corrugated iron outside; the 3-inch air-lock between the outer and inner walls is best left free of sawdust, as, if the latter becomes wet it acts as a dissipator of heat.

(3) The brazier should stand in a saucer-shaped well 12 inches below floor level; this should be lined with asbestos, cement, or fireclay; as 12 inches is too deep a step over which to carry a loaded brazier, a step 6 inches deep is required on each side of the well.



Sketch showing upper and lower tiers of rails for blankets, and blankets in position.

PLAN 4.—Improved design of a hot-air hut, by Captain J. T. Grant.
(Drawn by Serjt. F. G. Grierson, 1st London Sanitary Company).
Scale ½ of an inch = 1 foot.

(4) A cold-air inlet should be provided on each side of the hut by a six-inch pipe running under the floor and opening under the centre of brazier; the terminal part under the brazier ought to be detachable in order to facilitate removal of cinders. At the outer end should be, to suit the direction of the wind, a movable bent cowl, two feet six inches from the ground (see plan).

(5) A louvred or other ventilator on the roof is needed to prevent over-heating (in the absence of a fan) of the roof space, which acts as an air-lock to the ceiling. The trapdoor in the ceiling should be abolished, and in its stead should be introduced a hot-air outlet in the shape of a grating one foot square in each side wall, near the ceiling, at diagonally opposite corners of the hut; each outlet should be controllable by a chain or rope from outside, the current or movement of the hot air thereby obtainable aids penetration of heat into the materials.

(6) The tiers of bars should be two in number, upper and lower; the height of the lower should be 4 feet 6 inches from the ground, so that a 7-foot blanket extending downwards 3 feet 6 inches on either side of the bar does not come within 12 inches of the floor. The upper should be 3 feet 6 inches above the lower, and the upper bars should be opposite the lower spaces, not the lower bars, i.e., the first bar of the upper tier would be 4 inches from the wall, the first bar of the lower tier 8 inches from wall. The distance between bars should be eight inches. Not less than one foot of

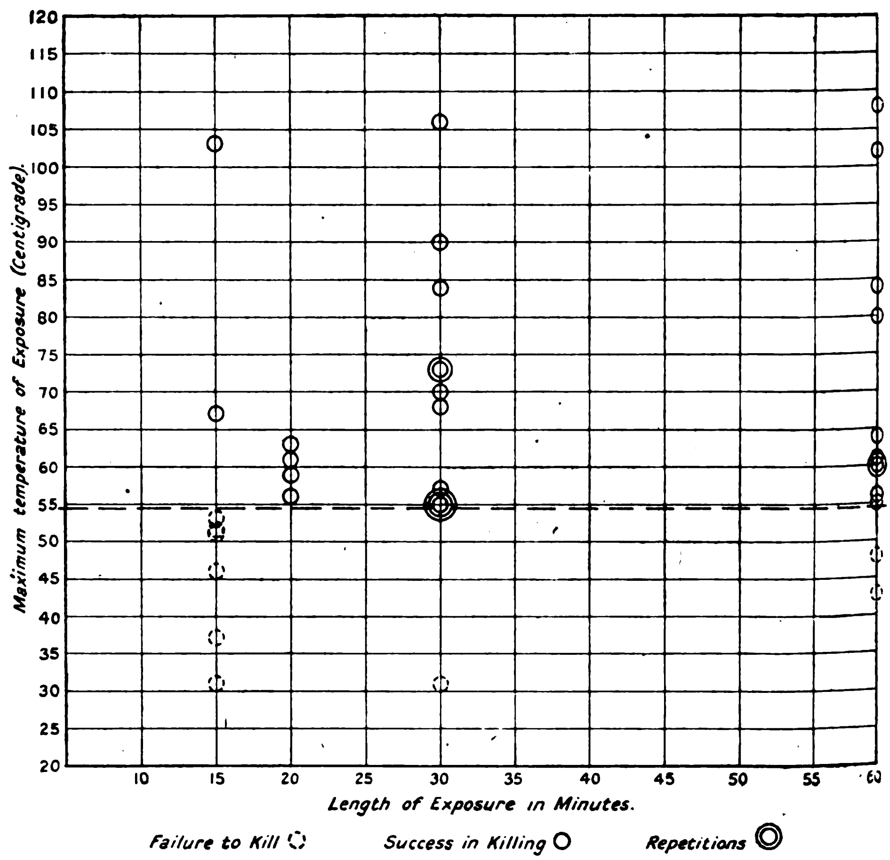


Diagram of experimental results, Hot-air Disinfestation Hut, Moore Barracks Hospital, Shorncliffe.

bar length should be allowed for carrying each puckered blanket; thus a four-feet bar takes four blankets, each arranged as already described. Slideable hooks on the bars, like curtain rings, are useful for attaching tunics, greatcoats, kilts, slacks, etc.

(7) A heat deflector, in the form of a sheet of iron should be placed across the mouth of the glowing brazier.

It may be mentioned that an improvisable and portable hot-air hut made of double walls of canvas, with a three-inch air space, has been found successful by Captain Grant and Lieutenant Peacock, the sources of heat being braziers formed of oil-drums converted into cradles and riddled with holes one inch in diameter.

A method of heating by flues connected with a furnace burning all kinds of fuel, including camp refuse, is under consideration.

The chart on p. 460 shows graphically the results of thirty-six tests (Tests Nos. 16, 17, 18 and 19 in Experiment IV. being omitted). It is to be noted that all the exposures at 55° C. or above were completely successful in the destruction of both active lice and nits, even when the exposure was no longer than fifteen minutes. Temperatures below 50° C. failed to kill. In the case of the three exposures between 50° C. and 55° C. the effect of the heat was variable; while all the active lice were destroyed, a few of the nits survived and hatched. The dotted line therefore indicates the safety limit of temperature under the conditions of test.

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THE DETECTION OF SLIGHT DILATATION OF THE HEART.

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A very large number of cases are seen in military practice in which the detection of *slight* dilatation of the left side of the heart is important.

We need not refer to the well-marked cardiac dilatation in valvular diseases, cardiac overstrain, "soldiers' heart," and marked disordered action of the heart. In this article we shall consider only the *slight* cardiac dilatation which may be detected in certain cases where the symptoms and signs are not marked. Different diagnoses are often given in such cases and not infrequently the men are regarded as malingerers.

Thus, to mention well-known instances—a man who appears healthy is called up for, or has been passed for, military service. He considers he is not suitable for active service, on account of shortness of breath on slight exertion, and requests a medical report on the condition of his heart. A soldier complains that he is unable to continue his duties or return to his duties, on account of shortness of breath on slight exertion, or of supposed cardiac affection. A discharged soldier when called up before a medical board complains that he is still unable to follow his employment on account of symptoms which he considers to be due to heart affection, and the question of continuing his pension has to be considered.

On examination of a large proportion of these cases we find no cardiac murmur, no signs of *well-marked* dilatation of the heart. The heart sounds are occasionally irregular or intermittent; but very often the heart sounds are regular and normal. We have no œdema or definite signs of failing heart, but the man complaims that on slight exertion he is very short of breath, and suffers from palpitation or dizziness, and occasionally from pain in the cardiac region, and that he is unable to do his duties on account of these symptoms.

Valvular disease of the heart, marked irregular cardiac action, *well-marked* dilatation of the heart, disease or affections of other organs, dyspepsia, flatulence, etc., can be excluded. In some of these cases the men are certainly malingerers or neurasthenic, or neurotic, and on careful examination of the cardiac dullness we find it normal. But in certain other cases, on very careful examination, we are able to detect *slight* but definite increase of the cardiac dullness to the left, indicating slight dilatation of the left ventricle of the heart. In many of these cases, on direct percussion over the apex of the heart (with the tip of the finger) the patient complains of tenderness or pain; occasionally he feels faint, and occasionally an attack of well-marked syncope will be produced thereby.

Other medical men, who have carefully examined the cardiac dullness,

will have found this slight increase in many cases in which the soldier complains of the symptoms just named, and will also have noted the tenderness on direct percussion over the apex and the occasional attacks of syncope produced.

I think we may regard this slight cardiac dilatation with cardiac muscle weakness as the cause of the symptoms in such cases, and at least as an indication against the diagnosis of malingering. The *slight* dilatation can only be determined by carefully mapping out the cardiac dullness, and also by *taking into consideration chest measurements.*

In this article I desire to consider (1) methods of sharply defining the cardiac dullness to the left; and (2) what are to be regarded as definite indications of slight cardiac dilatation from the extent of the cardiac dullness?

(I) Methods by which we may determine Dilatation of the Heart to the Left.

Before examining for the signs of slight cardiac dilatation we must exclude affections on the right side of the chest (such as pleuritic effusion) which might push the heart to the left.

Having done this, indications of the size of the left ventricle, as all medical practitioners are aware, are obtained from the position of the apex impulse, determined by inspection and palpation of the chest, or by placing the end of the stethoscope over the fifth intercostal space near the nipple line and noting the point where the pulsation is most marked, as indicated by the movement of the other end of the stethoscope. Also we have another indication of the position of the apex by noting the point at which the heart sounds are heard most distinctly by means of the stethoscope. This is oceasionally of service where the other indications are indefinite. These are sufficient indications in many cases of marked dilatation, but of course percussion should always be carried out. In the cases of *slight* dilatation considered in this article, percussion should be carried out very carefully, otherwise the dilatation will be overlooked.

Percussion of the left limit of the heart is usually carried out by placing the index or middle finger of the left hand in the fifth intercostal space over the lung area and percussing it repeatedly with the index or middle finger of the right hand—passing from the lung area towards the middle line. A dull note is obtained when the left limit of the heart is reached, and also the resistance is greater. But sometimes the difference is not sharply defined, and in most cases I much prefer *direct* percussion of the intercostal space with the tip of the middle finger of the right hand. The skin over the fifth intercostal space is directly percussed forcibly and repeatedly with the tip of the examiner's right middle finger, no finger of the left hand intervening, from the lung area to the cardiac region. On reaching the left limit of the heart the percussion note is *duller* and the *feeling of resistance* to the tip of the percussing finger is much greater over

the cardiac area than over the lung area. The greater resistance is often more easily determined than the duller percussion sound, and is as definite an indication of the limit of cardiac dullness, and for my own part I much prefer this *direct* method of percussion to the usual method, in most cases. I can much more readily distinguish the difference between the percussion resistance and the percussion note over the lung and cardiac areas respectively by this direct method, and can in most cases more sharply and clearly map out the left limit of the heart by this method than by the ordinary method.

The apex of the heart may also be mapped out with *two coins*—a shilling and a sixpence. The examiner holds the sixpence firmly in contact with the patient's chest and percusses it *very forcibly* with the rim of the shilling. By practice he is able to recognize distinctly the difference of the sound and of the feeling of resistance over the lung and cardiac areas.

The following is the way of holding the coins which is most convenient to myself. The examiner places the sixpence over the patient's left fifth intercostal space (well outside the nipple line) with the rim of the sixpence just above the upper edge of the sixth rib. He holds his left hand above the sixpence and presses its flat surface firmly in contact with the patient's skin (pressing its lower rim especially well into the intercostal space) with the left forefinger and thumb held at the rim of the sixpence (at the ends of its transverse diameter), the former on the axillary side, the latter on the sternal side of the sixpence. He percusses the centre of the sixpence with the rim of the shilling which he holds firmly between the tips of the right middle finger and thumb placed at the centre of the percussing shilling and the tip of the index finger placed on its rim.

The sixpence is placed in contact with the chest first over the lung area well outside the cardiac area, and then gradually moved towards the sternum as different parts of the fifth intercostal space are percussed. When the left limit of the heart is reached, the percussion sounds obtained by percussion with the coins are more sharply defined in the dull and resonant areas than by percussion with the fingers in the ordinary manner, and the feeling of resistance is different in the two areas. The cardiac area is duller and more resistant than the lung area. When the limit of dullness is fixed the chest is marked with a pen or blue pencil just below the lower end of the vertical diameter of the sixpence which is in contact with the chest. (Sometimes the limit can be so sharply defined that when the sixpence is placed with its vertical diameter exactly over the limit of the cardiac dullness, the percussion note over the sternal half of the sixpence is duller and the feeling more resistant than over the other half.) The difference in the percussion sounds over the cardiac area and the lung area, when two coins are used cannot be described in words, but with practice I think most medical men will be able to distinguish the difference and also to feel the difference in resistance.

(Another method of fixing the cardiac dullness is by percussion of the

sixth rib directly with the finger from the left to the middle line. The note is different when the left limit of the heart is reached. But the limit of this dullness is always less than that obtained by percussing the interspace and is useful only as a rough estimate.)

In marking the limit of the cardiac dullness, when the chest is percussed directly with the tip of the finger, the duller and more resisting part is reached, the finger is kept in contact with the patient's skin and a mark made with ink or blue pencil. The mark should not be made at the finger nail, nor at the palmar surface of the finger end, but at the exact tip of the terminal phalanx of the finger, about the middle of the tip of the finger, about $\frac{1}{8}$ inch from the inner side of the finger nail.

In certain cases when the patient is stout, percussion in the usual manner, indirectly, is the most satisfactory method. The middle finger of the left hand is placed vertically on the chest in the fifth intercostal space and this is percussed with the middle finger of the right hand, from the lung area to the cardiac area.

In other very stout men percussion of the chest in any way is often very unsatisfactory and the size of the left side of the heart must be determined from the position of the apex impulse if this can be seen or felt, or by noting the point at which the heart sounds are best heard in the interspace and marking this as the apex of the heart. In these cases the *slight* dilatation we are considering cannot be estimated.

(II) What are the Indications of slight Dilatation of the Heart?

Having mapped out the cardiac dullness on the chest, and marked the left limit by ink or blue pencil, we have next to decide if this is greater than the normal limit. We mark with blue pencil or ink the mid-sternal line at the level of the fifth intercostal space. We measure the distance of the extreme left of the cardiac dullness from the mid-sternal line and we have then to decide if this is greater than the normal limit. The left limit of the cardiac dullness is normally *about* three inches from the mid-sternal line in the fifth intercostal space, and is *about* $\frac{1}{2}$ inch within the nipple line. But the limit varies in healthy men, and it may be $3\frac{1}{2}$, $3\frac{3}{4}$, or occasionally even 4 inches from the mid-sternal line in very well-developed normal men. I have carefully measured the cardiac dullness from the mid-sternal line to the left limit in fifty soldiers *free from any signs or symptoms of cardiac disease* or from any medical ailment. The extent of the left limit of the cardiac dullness from mid-sternum was not over $3\frac{1}{2}$ inches in 46 cases (in 24 of these it was 3 inches or under). In 4 of the 50 cases it exceeded $3\frac{1}{2}$ inches (in 2 cases it was $3\frac{3}{4}$ inches, in 2 cases $3\frac{5}{8}$ inches), but in all of these the chest was well developed, and when compared with the chest measurement (as described in this article) the figures were under the normal limits.

This difference in the extent of the cardiac dullness in healthy men shows that we must consider other relations, besides the measurement of the left limit of the cardiac dullness from mid-sternum, before we can decide if the heart is *slightly* dilated. If we find then that the left limit of the cardiac dullness extends more than 3½ inches from mid-sternum, before deciding that the heart is dilated we have to consider the relations of the cardiac dullness to the size of the chest. Three relations are useful: the relation to the transverse diameter of the chest, to the circumference of the chest, and to the nipple line.

In deciding if the heart is slightly dilated I have based my conclusion on four measurements:—

(1) The distance of the left limit of the cardiac dullness is measured from the mid-sternal line.

(2) The distance of the nipple line is measured from the mid-sternal line.

The transverse diameter of the left half of the chest is measured from the mid-sternal line at the level of the apex of the heart in the fifth interspace, the arms hanging down by the side, and the patient counting from one up to twenty rapidly. The chest is measured at the end of expiration. This half chest diameter may be measured in various ways. I usually employ two flat rulers marked in inches. One ruler (*a*) is placed in contact with the front of the chest horizontally; the other (*b*) is placed at right angles to it on the most prominent part of the side of the chest in the axillary region (felt by the hand). The second ruler (*b*) is held *exactly* at right angles to the first ruler (*a*) and the distance of the ruler (*b*) from the mid-sternal line is read off on the graduated transverse ruler (*a*) held in front of the chest.

Half the circumference of the chest is measured at the level of the apex of the heart in the fifth intercostal space. The tape measure is fixed at the mid-sternal line and passed horizontally round the left half of the chest at the level named and just under the scapula, the arms hanging down by the side. The tape measure is passed between the left arm and the chest, and the distance from mid-sternal line to the vertebral spines measured during expiration, whilst the man is counting twenty.

If we find the left limit of the cardiac dullness extends a little more than 3½ inches from mid-sternal line this may be due to dilatation of the heart, but before we decide such is the case the other relations just named should be considered.

The nipple line is a useful indication in many cases and the left limit of the cardiac dullness in healthy men is usually ½ inch inside the nipple line. If the dullness extends up to the nipple line cardiac dilatation is probable, but we have to remember that the nipple in males differs somewhat in the distance from the sternum. In most cases it is from 3½ to 4½ inches from mid-sternal line, occasionally 5 inches; so that if the nipple line is more than the usual distance from mid-sternum the heart might

be slightly dilated and the dullness still not up to the nipple line. (In the female the nipple line is, of course, not a satisfactory guide.)

From measurements in a large number of cases I have found the following relations of service: The distance of the left limit of the cardiac dullness from mid-sternum is normally not more (usually it is $\frac{1}{4}$ inch less) than two-thirds of the transverse diameter of the left half of the chest at the level of the apex in the fifth intercostal space.

The normal distance of the left limit of the cardiac dullness from mid-sternum is about one-fifth of the circumference of the left half of the chest at the level of the apex in the fifth intercostal space; it may be slightly more, but *is not so much* as $\frac{1}{2}$ inch above this. If the patient is very stout the value of this measurement is greatly diminished, as the figure might then be so much increased that cardiac dullness, though increased, would not exceed it.

If the cardiac dullness were not greater in the chests of well-developed men, any increase over 3 or $3\frac{1}{2}$ inches from the mid-sternum would indicate cardiac dilatation; but as already stated the dullness may be over $3\frac{1}{2}$ inches in normal well-developed men. If we allow that the cardiac dullness is greater in well-developed chests and that it *increases in proportion* to the size of the chest, then the measurement just named will be a guide of practical importance. If the cardiac dullness is not greater in proportion to the size of the chest, then we shall underestimate the cardiac dilatation by basing it on the measurement named, but we shall be quite correct in our decision in the cases which we regard as dilated heart.

To state this in other form, I think we may say that a cardiac dullness not extending over $3\frac{1}{2}$ inches from mid-sternum may be considered normal. But we may fairly regard the cardiac dullness to be increased and the heart dilated, if the left limit of the cardiac dullness extends :—

(1) More than $3\frac{1}{2}$ inches from mid-sternum.

(2) If, at the same time, but not otherwise, it is *over* two-thirds of the transverse diameter of the left half of the chest at the level of the apex in the fifth intercostal space, and especially if it is $\frac{1}{4}$ inch more than this (i.e., if it is $\frac{1}{2}$ inch over the normal limit).

(3) And if it is *as much as* $\frac{1}{2}$ inch over one-fifth of the circumference of the left half of the chest at the level of the apex in the fifth space. We may say that normally the extent of the cardiac dullness is *not over* limit two and is *under* limit three.

(4) If the dullness extends to the nipple line this is also a point in favour of cardiac dilatation. When the dullness is only slightly increased sometimes it does not quite reach the nipple line, especially if the nipple is over the average distance from mid-sternum; but in other cases the dullness though only slightly increased reaches all of the four limits just named.

We find in a series of cases of soldiers who have not suffered from any cardiac symptoms or any medical affection that the cardiac dullness never exceeds the limits (2), (3) and (4) just indicated. In certain other cases

with the symptoms just described, shortness of breath, palpitation, cardiac pain, we find the cardiac dullness slightly exceeds the limits (1), (2) and (3) indicated in this article as the normal limits, and in such cases I think we are justified in regarding this slight increase of cardiac dullness as an indication of slight cardiac dilatation and an indication that the symptoms are not due to neurosis and also that the man is not malingering.

In all of the normal cases examined, the distance of the left limit of the cardiac dullness from the mid-sternal line was not more than two-thirds of the transverse diameter of the left half of the chest; usually it was at least $\frac{1}{4}$ inch less. An increase over two-thirds of the transverse diameter of the chest and especially an increase of $\frac{1}{4}$ inch over this (i.e., half over the usual limit) may I think be regarded as an indication of slight cardiac dilatation.

The distance of the left limit of the cardiac dullness from mid-sternum was about one-fifth of the half circumference of the chest at the level of the apex of the heart, sometimes a little more than one-fifth, but never over $\frac{1}{2}$ inch more than this. If $\frac{1}{2}$ inch more, this may be regarded as a sign of slight cardiac dilatation.

For example in Case 10, the cardiac dullness extended $3\frac{3}{4}$ inches from mid-sternum, but the transverse diameter of the left half of the chest was 6 inches and two-thirds of this is 4 inches. Half of the circumference of the chest at the level of the apex of the heart was $17\frac{1}{4}$, one-fifth of this is $3\frac{9}{20}$; if we add $\frac{1}{2}$ inch the figure is $3\frac{19}{20}$. The distance of the nipple line was $4\frac{3}{8}$. The extent of the cardiac dullness was thus less than all of these figures and may therefore be regarded as normal in this case. The man had no cardiac symptoms.

The following Table I gives the figures in ten of the fifty cases of normal soldiers examined. (These soldiers did not suffer from any symptoms of cardiac affection.)

TABLE I.—RELATIONS OF CARDIAC DULLNESS TO CHEST MEASUREMENTS IN NORMAL CONDITIONS.

Case	Distance of left limit of cardiac dullness from mid-sternal line	Distance of nipple line from mid-sternal line	Two-thirds of the maximum transverse diameter of left half of chest at level of apex of heart	One-fifth of the left half of the chest circumference, from mid-sternal line to vertebral spine, at level of apex of heart, plus $\frac{1}{2}$ inch
1	3 inches	$3\frac{5}{8}$ inches	$3\frac{2}{3}$ inches	$3\frac{6}{10}$ inches
2	3 „	4 „	$3\frac{2}{3}$ „	$3\frac{7}{10}$ „
3	$2\frac{3}{4}$ „	$4\frac{1}{8}$ „	$3\frac{3}{8}$ „	$3\frac{8}{10}$ „
4	$2\frac{7}{8}$ „	$3\frac{3}{4}$ „	4 „	$3\frac{9}{10}$ „
5	$2\frac{5}{8}$ „	$3\frac{1}{2}$ „	$3\frac{1}{3}$ „	$3\frac{4}{10}$ „
6	$3\frac{1}{4}$ „	$3\frac{7}{8}$ „	4 „	4 „
7	$3\frac{1}{2}$ „	$4\frac{1}{4}$ „	$4\frac{1}{8}$ „	$3\frac{9}{10}$ „
8	$3\frac{1}{2}$ „	$4\frac{1}{8}$ „	$3\frac{2}{3}$ „	$3\frac{19}{20}$ „
9	3[illegible] „	$4\frac{5}{8}$ „	$4\frac{1}{4}$ „	4 „
10	$3\frac{3}{4}$ „	$4\frac{3}{8}$ „	4 „	$3\frac{19}{20}$ „

In a large number of the men who complained of the cardiac symptoms described in this article we find that the extent of the cardiac dullness exceeded the limits of the cardiac dullness in normal men.

Thus in Case 6 of the following Table II we find the cardiac dullness was $4\frac{1}{8}$ inches from mid-sternum, i.e., more than $\frac{1}{2}$ inch beyond the usual limit: but as already stated this limit may be exceeded in healthy men when the man is well developed and the chest large. We find in this case that the cardiac dullness extended up to the nipple line which was $4\frac{1}{8}$ inches from mid-sternum. Also the transverse diameter of the left half of the chest was $5\frac{1}{4}$ inches and therefore not above the average; and two-thirds of this diameter is $3\frac{1}{2}$ inches. The circumference of the left half of the chest at the level of the apex of the heart was fifteen inches. One fifth of this is three inches and if we add $\frac{1}{2}$ inch the figure is $3\frac{1}{2}$. The limits of this cardiac dullness thus exceeded all the limits and relations found in healthy men, and the heart may be regarded as dilated. The man complained of the cardiac symptoms described in this article.

In Case 3 the left limit of the cardiac dullness was $3\frac{3}{4}$ inches from mid-sternum and this extent may be noted in some healthy men; but we find that the relations to chest measurements show that the limit is abnormal in this case. We find that the transverse diameter of the left half of the chest was $4\frac{7}{8}$: two-thirds of this is $3\frac{1}{4}$. The circumference of the left half of the chest at the level of the apex of the heart was $15\frac{3}{4}$ inches. One-fifth of this was $3\frac{3}{20}$; if we add $\frac{1}{2}$ inch we have the figure $3\frac{13}{20}$. The cardiac dullness thus exceeded all the limits and relations found in healthy men and the heart may be regarded as dilated. The man complained of cardiac symptoms.

TABLE II.—RELATIONS OF CARDIAC DULLNESS TO CHEST MEASUREMENTS WHEN THE HEART WAS SLIGHTLY DILATED.

Case	Distance of left limit of cardiac dullness from mid-sternal line	Distance of nipple line from mid-sternal line	Two-thirds of maximum transverse diameter of left half of chest at level of apex of heart	One-fifth of circumference of left half of chest, from mid-sternal line to vertebral spine, at level of apex of heart, plus $\frac{1}{2}$ inch
1	$3\frac{7}{8}$ inches	$3\frac{7}{8}$ inches	$3\frac{5}{12}$ inches	$3\frac{6}{10}$ inches
2	$3\frac{7}{8}$,,	4 ,,	$3\frac{1}{2}$,,	$3\frac{6}{10}$,,
3	$3\frac{3}{4}$,,	$4\frac{1}{4}$,,	$3\frac{1}{4}$,,	$3\frac{13}{20}$,,
4	$3\frac{7}{8}$,,	$3\frac{7}{8}$,,	$3\frac{1}{2}$,,	$3\frac{13}{20}$,,
5	$4\frac{1}{8}$,,	$4\frac{1}{8}$,,	$3\frac{3}{4}$,,	$3\frac{4}{5}$,,
6	$4\frac{1}{8}$,,	$4\frac{1}{8}$,,	$3\frac{1}{2}$,,	$3\frac{1}{2}$,,
7	$4\frac{1}{2}$,,	$4\frac{3}{4}$,,	$3\frac{3}{4}$,,	$3\frac{8}{10}$,,
8	$4\frac{1}{2}$,,	$4\frac{1}{2}$,,	$3\frac{2}{5}$,,	4 ,,
9	4 ,,	4 ,,	$3\frac{2}{3}$,,	$3\frac{3}{4}$,,
10	4 ,,	4 ,,	$3\frac{1}{2}$,,	$3\frac{13}{20}$,,

In Case 10 the left limit of the cardiac dullness was four inches from mid-sternum, i.e., over the normal limit for most healthy men. We find

that the transverse diameter of the left half of the chest was $5\frac{1}{4}$ inches. Two-thirds of this is $3\frac{1}{2}$ inches. This was exceeded by the cardiac dullness. The circumference of the left half of the chest at the level of the apex was $15\frac{3}{4}$ inches. One-fifth of this is $3\frac{3}{20}$. If we add $\frac{1}{2}$ inch the figure is $3\frac{13}{20}$. This is also exceeded by the cardiac dullness. Also the cardiac dullness reaches the nipple line: so that all three normal limits were exceeded and the heart is dilated slightly but definitely. The man complained of cardiac symptoms.

The following are examples of the measurements in ten cases of slight cardiac dilatation taken from a large number examined. The men all had the slight cardiac symptoms mentioned in this article.

We may consider the cardiac dullness normal if it does not extend *more than $3\frac{1}{2}$ inches from mid-sternum.* If it extends a little more than that distance it may be normal or abnormal according to the chest measurements, as already described.

The following are three useful indications:—

Transverse diameter of left half of chest	Extent of normal cardiac dullness from mid-sternum *not more than*
$5\frac{1}{4}$ inches or under	$3\frac{1}{2}$ inches
$5\frac{1}{2}$,, ,,	$3\frac{2}{3}$,,
6 ,, ,,	4 ,,

Circumference of left half of chest at level of apex	Extent of normal cardiac dullness from mid-sternum *under*
15 inches or under	$3\frac{1}{2}$ inches
$16\frac{1}{4}$,, ,,	$3\frac{3}{4}$,,
$17\frac{1}{2}$,, ,,	4 ,,

If a man complains of much shortness of breath on slight exertion, of palpitation or dizziness, of slight pain in the cardiac region and considers that his heart is affected, and if we find no signs of valvular disease and no striking or *well-marked* signs of cardiac dilatation, and no œdema of the feet or other indications of cardiac failure than those named in this article, and no indications of flatulence or dyspepsia, before dismissing the case as one of malingering or neurosis, a careful examination of the cardiac dullness is desirable.

Malingerers should not be exempted from military service, and the pensions of malingerers should not be continued, but we must remember that it is equally important that a man who has served his country well should not be dismissed as a malingerer or neurotic man and his pension cut off or unfairly reduced, if he is suffering from cardiac muscle affection or failure. The detection of cardiac dilatation is of value in helping us to decide between the two classes of cases.

If the cardiac dullness is not increased and the heart sounds are normal we cannot, of course, say that the heart is therefore normal and the man a malingerer. But if the cardiac dullness is definitely though only slightly increased we have a clear indication in favour of the opinion that his symptoms are due to cardiac affection and that the man is not merely

neurotic or a malingerer, and the practical importance of this slight increase of cardiac dullness may be demonstrated in a striking manner by the cardiac symptoms which occasionally occur in such cases. If the cardiac dullness is increased and the heart dilated the man will of course often improve by suitable treatment and slowly graduated exercises and training, and be able to continue his duties in course of time.

I have found the method of mapping out the cardiac dullness by direct percussion with the finger, or by coins, of much service; and the relation of the extent of the cardiac dullness to all of the three chest measurements described in this article is a most valuable indication in deciding if the heart is dilated.

Clinical and other Notes.

THE EARLY SYMPTOMS FOLLOWING INFECTION BY *SCHISTOSOMUM MANSONI.*

By Major F. Blois Lawton.
Australian Army Medical Corps.

In August and September, 1916, twenty-four cases were admitted to the Australian General Hospital in Cairo suffering from some or all of the following symptoms: Abdominal pain, enlarged and tender liver and spleen, pyrexia, bronchitis, urticaria and diarrhœa.

All the patients were Australians who had not travelled before enlistment. At first it was not clear what was the matter with these men and blood cultures were made and other investigations carried out with negative results, but the blood picture afforded the key. In every case a striking eosinophilia was present. This led to prolonged examination of the stools for parasites and resulted in the discovery of the lateral spined ova of *Schistosomum mansoni*. The ova were found ultimately in the stools of all. The ova were scarce at this stage of the disease as presumably the majority of the paired adult worms had not yet found a suitable home in the veins draining the rectum.

All of these patients had been in camp at Tel-el-Kebir during the three months preceding the onset of symptoms and it was there that the infection was apparently contracted. Near the rifle range used by the men in camp there is a fresh water canal, in which the water flows sluggishly and the infected men had either bathed or washed in that canal. Most of them had been fully immersed, having swum in the water, but one man had merely washed his hands and another had washed cooking utensils in it. In the last two the infection was quite as severe as in the others. Some of the patients had swum more than once. None of them had washed in any other fresh water in Egypt except the shower baths and water provided for ablution. Itchiness of the skin was observed by several on coming out of the water. None of them had used towels. None of the patients could remember having drunk the water.

Following are notes of three cases :—

Case 1.—Admitted August 18.

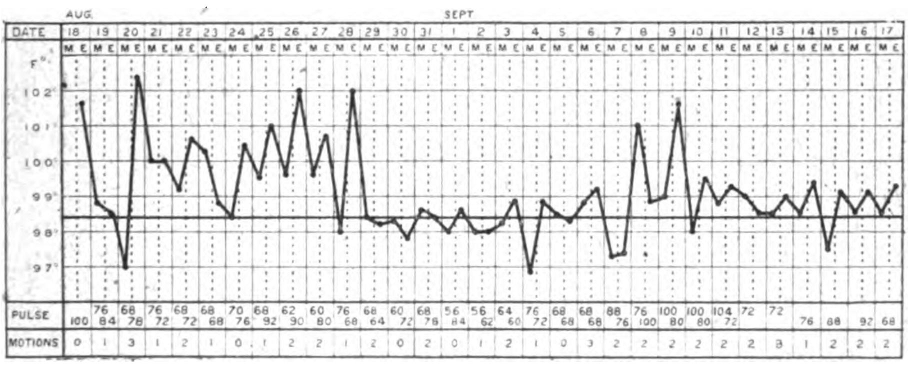
Past History.—Was overseer on a sheep station, New South Wales. Had had no sickness. Arrived in Egypt June, 1916. Bathed in fresh-water canal at Tel-el-Kebir about July 18.

Present Illness.—This began with a cough about a fortnight ago. He says that his sputum was stained with blood. At the same time he had headache and loss of appetite. These symptoms continued till four days ago, when he had sharp pains in the upper abdomen extending round the right side to his back. To-day the pain became general all over his abdomen. He had retching but no vomiting. His bowels were normal till two days ago, when he had diarrhœa, which continued till this morning. To-day there have been sweating and shivering.

On examination he looks sick and is flushed, and has a hot dry skin. Tongue

moist and slightly furred. Chest scattered rhonchi. There is a little mucoid sputum which is not blood stained. Abdomen: Distension and tenderness all over. Good movement. The maximum tenderness is in the right iliac fossa, and over the spleen and liver, which are enlarged and palpable. Urine normal. Blood culture was made on the night of admission. The result was negative. August 19: Leucocyte count, 20,000. August 20: Shiver. Blood film made and examined for malarial parasites. No parasites found, but high eosinophilia was revealed. August 21: Blood films made for differential white count. Result: Polymorphonuclears, 22·5 per cent; small mononuclears, 15·5 per cent; large mononuclears, 2·0 per cent; eosinophiles, 60·0 per cent. August 24: Urticaria on body and limbs. Present for seven days. Complaining of discomfort after food. August 29: Feels better; has no pain. August 31: Stool examined by pathologist. Large and small amœbæ of coli type and coli cysts and blastocystis and cysts were found. September 2: Stool again examined. Same result. September 6: Headache; slight shiver: abdominal pain. September 11: Shivered during night, complaining of headache, abdominal pain and fullness after food. Pain most severe and tenderness most marked in left lower abdomen. Has a little diarrhœa. Stool again examined and lateral-spined bilharzia ova were found. September 13: Abdominal pain during night. Discomfort after food this morning. September 20: Has improved, but abdominal pain and discomfort after food are still present. Liver and spleen are enlarged and easily palpable. September 23: Discharged to Australia as cot case.

CHART 1.



Case 2.—Admitted August 28.

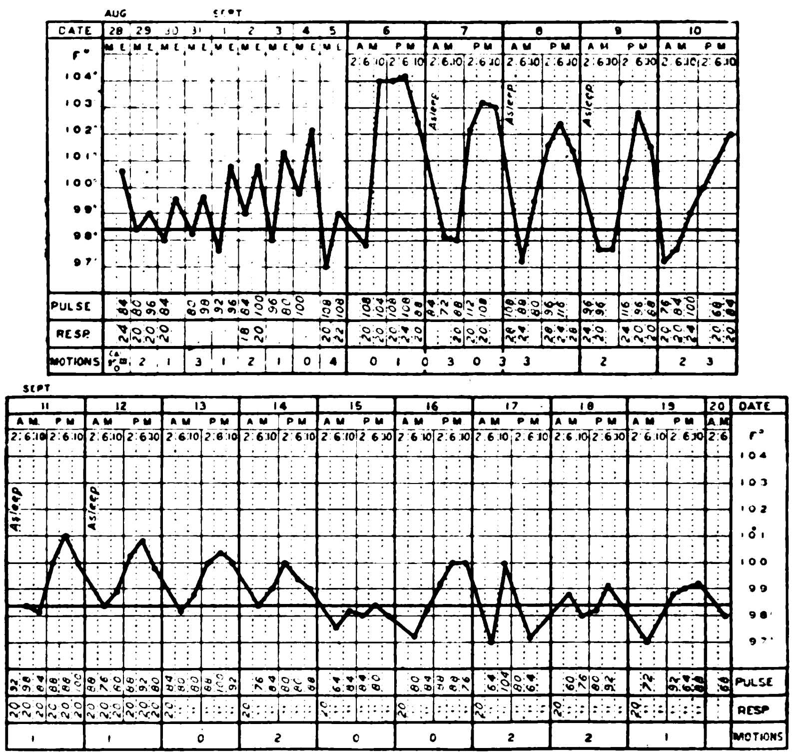
Past History.—Fitter in an iron foundry in Western Australia. No illness before enlistment. At Gallipoli three months. Sent off with dysentery and was in hospital in England three months. Returned to Egypt February, 1916. Swam in Canal at Tel-el-Kebir at end of May and beginning of June.

Present Illness.—Illness began on August 12, when he felt hot and giddy and had headache and pain across the lower abdomen; he had shivers and night sweats. There was no cough and no vomiting. He was constipated. Micturition normal. He was sent to a field ambulance and was transferred thence to a stationary hospital where he remained for about a fortnight before going to Cairo.

On admission.—Does not look sick and is lying comfortably on his back. Tongue

moist and slightly furred; chest normal. Abdomen—Good movement, no distension. Tenderness in right iliac fossa and enlargement and tenderness of liver and spleen. August 30: Urticaria present for two days. September 1: Leucocyte count 17,000. Differential white count: Polymorphonuclears 16 per cent, small mononuclears 25·5 per cent, large mononuclears 3·5 per cent, eosinophiles 55·5 per cent. September 5: Diarrhœa. Stool examined by pathologist. Report—stool liquid, no mucus or blood. Heavy lamblia cyst infection. No other parasites found. September 6: Severe pain in upper abdomen; tender over upper part of right rectus which is rigid. September 9: Stool examined, same report as on the 5th. September 11: Stool examined, lateral-spined bilharzia ova present. September 20: Improved, but still has attacks of severe abdominal pain, and much discomfort after food. Liver and spleen enlarged. He is very wasted. September 23: Discharged to Australia as cot case.

CHART 2.



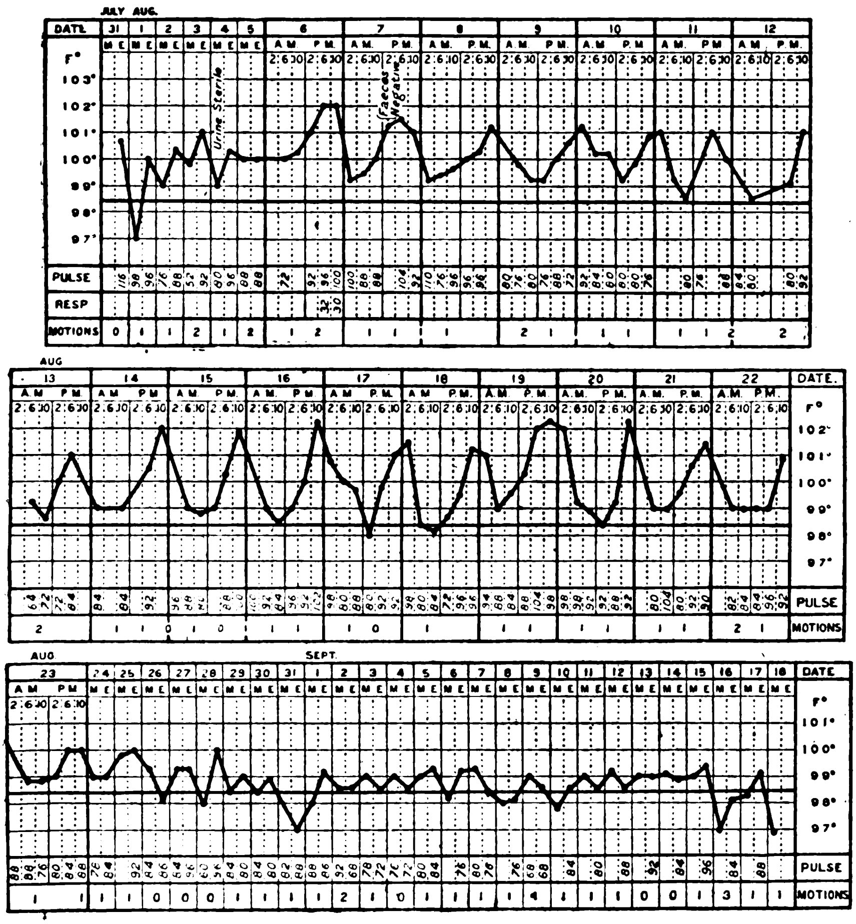
Case 3.—Admitted August 25.

Past History.—Farmer, Victoria. No illness before enlistment. Had measles in camp in Australia and recovered completely. Egypt February, 1916. Influenza March, 1916, good recovery. Swam in fresh water canal at Tel-el-Kebir at the end of May.

Present Illness.—At the onset at the end of June he had headache and dizziness

and felt weak. He reported sick on July 9 with these symptoms, pains all over and feverishness. He was sent to a Stationary Hospital and remained there for three weeks, during which time he had headache and pyrexia. In hospital he developed a cough. He was thought to have an enterica infection and was sent to an infectious diseases hospital on July 31. There the same symptoms continued. The cough became worse and was very troublesome at night and he had night sweats. Blood examinations for enterica were negative. His urine

CHART 3.



was sterile and fæces negative for organisms of the enterica group. August 18: Leucocytes 18,000. August 20: Sputum negative for tubercle bacilli. August 25: Transferred to No. 3 Australian General Hospital. Examination—Looks sick, is pale and wasted, tongue moist, white fur in centre, teeth very bad, severe pyorrhœa; signs of bronchitis in chest; liver not felt but dullness extends to the fourth rib in the nipple line; spleen palpable; he states that he had a rash about a fortnight after the onset; urine normal. August 26: Differential white

count, polymorphonuclears 15 per cent, small mononuclears 14 per cent, large mononuclears 3 per cent, eosinophiles 68 per cent. August 29: Stool examined. Report—liquid stool, blood and mucus present; trichomonas and lamblia cysts present; no amœbæ or cysts seen. Many Charcot's crystals. August 31: Stool examined, similar results. September 7: Stool examined, similar results. September 10: Stool examined, similar results. September 11: Stool examined, lateral-spined ova of bilharzia present and living miricidium seen. September 20: From August 29 there was considerable improvement; but the cough continued to be very troublesome, especially at night, and caused loss of sleep. There was sometimes abdominal pain and discomfort after food, and his bowels were often loose; he had frequent night sweats; he was discharged to Australia as cot case on September 23.

Incubation Period.

The period of incubation was not as a rule easy to fix accurately, for the date of exposure to infection often could not be given definitely and, when the symptoms had appeared, some weeks before the patients were transferred to the base, the exact time of their onset was, in some instances, unknown. The shortest incubation period was four weeks, and the longest was about three months. Most often it was between four and eight weeks. This is shorter than the incubation period in vesical bilharziosis and none of the patients had signs or symptoms of that condition and ova were not found in their urine. But it is possible that symptoms of vesical bilharziosis may have become manifest later, for both types of bilharzia exist in the water where the rectal disease was acquired, for a patient who swam in the same water was admitted to No. 14 Australian General Hospital with vesical bilharziosis.

Symptoms (General).—Onset. This was sometimes abrupt, but more often the patients felt out of sorts for a few days, with loss of appetite, persistent headache, pains in the back and limbs and dizziness. There was usually a cough in the early stages. Sometimes cough was the first symptom. Vomiting was uncommon. These symptoms were followed by abdominal pain, which was often accompanied by diarrhœa. At the onset the pain was usually in the lower abdomen, but in a few cases pain in the upper abdomen was first noticed and later in the illness the most troublesome pain was in the right upper abdomen. During the first weeks of illness, there was pyrexia with hot dry skin and dirty tongue.

In some instances, however, the illness appeared to have been mild from the beginning. The temperature was remittent with an evening rise to 102° F. or 103° F. The temperature remained high for about ten days and then descended and sometimes it did not rise again above 99° F. or 100° F., but in other cases after seven to ten days another pyrexial period ensued. In a few cases the period of pyrexia extended over several weeks, the longest being about eight weeks. Shivers and sweats were frequent. The latter generally occurred at night and were sometimes severe. Headache was usually a troublesome symptom. Notwithstanding the temperature, the pulse was slow. Dicrotism was observed once. Later there was invariably an evening rise to 99° F. or 100° F. either daily or at intervals of two to three days, as long as the patient was under observation.

Urticaria.—Urticaria was always present at some stage of the disease and in patients who were seen soon after the onset it appeared in the second or third week. Its duration was variable, being from twelve to forty-eight hours as a rule, but in some cases it remained for seven or eight days. Its distribution was general, large wheals being scattered over the body and limbs. Often it had come and gone before the patients were sent to the base. In one case the urticaria recurred several times.

Blood Changes.—The red corpuscles were counted and hæmoglobin estimated in only two cases and these showed no changes. There was always a leucocytosis. It varied from 13,000 to 22,000 and was usually about 18,000. Differential white cell counts invariably gave a high eosinophilia. This was never lower than thirty-six per cent and was most often about fifty per cent. The highest was seventy-six per cent.

In cases of bilharzia hæmatobium previously reported the eosinophilia was generally lower.

Coles [1] found twenty per cent and Balfour [2] fourteen to eighteen per cent.

Douglas and Hand [3] in fifty cases found the eosinophilia was less than 5 per cent in 1 case, less than 10 per cent in 13, less than 15 per cent in 12, less than 20 per cent in 11, less than 30 per cent in 10 and greater than 30 per cent in 3.

Kautsky bey [4] reported no leucocytosis, and red cells not diminished and hæmoglobin 50 to 80 per cent. In 22 cases the eosinophilia was in 5 cases 5 to 10 per cent, 12 cases 10 to 20 per cent, 2 cases 20 to 30 per cent, 2 cases 40 per cent, and in 1 case 53 per cent.

Catouillard and Gober [5] described the following blood picture: Red corpuscles 3 to 5 million, white corpuscles 8,525 to 10,850, eosinophiles 5 to 26 per cent.

Nathan Laxrier [6] estimated the eosinophiles to be from 5 to 25 per cent.

Zweifel [7] gave the blood picture as: Red corpuscles 2,700,000 to 7,780,000, white corpuscles 4,500 to 17,500, eosinophiles 3 to 35 per cent.

Symptoms, Abdominal.—The abdomen was often distended. At first it was tender all over, but the maximum tenderness was over the descending colon and in the right upper quadrant and in the latter area the muscles were held on guard. The tenderness was very marked in the beginning but gradually diminished. It never entirely disappeared, some tenderness over the descending colon and over the liver remaining. The liver and spleen were enlarged, easily palpable and tender. Enlargement of those organs was found without exception in the first weeks, but though the liver continued to be palpable the spleen after three or four weeks could not in many cases be felt. Attacks of pain in the upper abdomen were frequent and often severe but the most distressing symptom was a feeling of fullness in the epigastrium after taking any nourishment. This was a constant and persistent symptom, and was the cause of much discomfort. Attacks of diarrhœa occurred but were not very common and not severe and rarely were present for more than twenty-four hours. During such attacks blood and mucus were often passed. With the diarrhœa tenesmus sometimes occurred but gave little trouble.

Diarrhœa, however, was in a few cases the outstanding feature of the illness and continued for from two to three weeks. When this was so, blood and mucus

were abundant in the stools and tenesmus was marked. In the absence of diarrhœa, or when the diarrhœa was present only for a few days, and had passed off, a little blood and mucus often insufficient to attract the patient's attention was the only abnormality seen in the stool. Often the stool appeared to be normal. In every case the stool sooner or later contained the lateral-spined ova of *Schistosomum mansoni*. Usually the ova were found at this stage of the disease only after prolonged search. Sometimes they were more readily found in mucus removed from the rectum.

Pulmonary.—Cough was sometimes the most prominent symptom and in a few instances it was present during the whole of the patient's stay in hospital. In the chest there were signs of bronchitis and in some cases there were also patches of consolidation. These signs usually cleared up fairly quickly, but in one case they were present for more than ten weeks, and were still present when the patient was discharged from hospital. Generally, the chest symptoms did not cause great inconvenience, but in some patients the cough was worse at night and resulted in loss of sleep.

Course of the Disease.—In most of the cases observed the tendency was for the symptoms to moderate after a varying time in which the patients were acutely ill. When the earlier stages were severe and the pyrexial period protracted there was considerable emaciation and weakness. Though the symptoms moderated, in no case did they clear up completely. All the patients remained weak, but improved a little and their weight increased. They were troubled by frequent headaches, occasional attacks of abdominal pain and diarrhœa and the feeling of fullness after food. Sometimes the condition of the bowels was normal and sometimes there was constipation. In some cases the acute stage had been passed before the patients reached the base and they were in this chronic condition when first seen.

Parallelism with Katayama Disease.—The early symptoms in these cases of rectal bilharziosis resembled, in a general way, those described in katayama disease, and the symptoms and course of the illness in some of these cases were very similar to those in cases of katayama disease reported by Bassett-Smith [8] and Edgar [9]. Though resembling it in a general way, the illness was less severe than that described in the katayama disease, for there was no ascites or œdema of the legs and there were no deaths.

A search of the literature showed an absence of any record of these early symptoms in infection by *S. mansoni*. All state that the first symptoms are those occasioned by the presence of the worm in the mucous membrane of the intestine Sandwith [10] in 1905 stated that "no symptoms are known to show when liver and lungs are affected."

The only observation indicating any recognition of an earlier febrile state set up by the development of the embryo in the liver is a note by Archibald [11], who described three cases of pyrexia of unknown origin which, at post-mortem, were found to have intestinal schistosomiasis. He emphasizes the fact that in these cases there was no eosinophilia.

Differential Diagnosis.

No. 1, *Dysentery.*—When the illness began with diarrhœa accompanied by the passage of blood and mucus and by abdominal pains and tenesmus, there

was a close resemblance to dysentery. In such cases dysentery was excluded by examinations of the stools for protozoa and bacilli.

No. 2, *Enterica.*—The early symptoms sometimes were suggestive of an enterica infection. This was always excluded on further investigation.

No. 3, *Urticaria.*—In some cases men first reported sick with urticaria, and when they were not very ill the condition was regarded as the result of some intestinal toxæmia and they were not sent to hospital till other symptoms appeared. In a few cases the first symptoms to attract attention were painful swellings of the eyelids and lips, and on the limbs, and in the absence of other symptoms a diagnosis of angioneurotic œdema was made.

No. 4, *Pulmonary Tuberculosis.*—When cough was the most prominent symptom and there were also wasting, evening rise of temperature and night sweats, and signs of bronchitis and consolidation, pulmonary tuberculosis was diagnosed. Several patients were admitted to hospital with this diagnosis and repeated examinations were made of the sputum for tubercle bacilli, but none were found.

No. 5, *Hepatic Abscess.*—In two cases this condition was thought to be present. In the first the liver was explored with a large needle, and pus was not found. This man had a history of dysentery a few months previously. The second man came in after a diagnosis of bilharziosis had been made in a number of other cases. A blood film showed an eosinophilia and bilharzia ova were found in his stools.

No. 6, *Ulcerative Endocarditis.*—One man presented a clinical picture very suggestive of this condition. Two blood cultures were made and both were negative. A blood film showed a high eosinophilia.

I wish to thank Colonel B. J. Newmarch, C.M.G., V.D., Commanding Officer of No. 3 Australian General Hospital, for permission to publish these notes. To Lieutenant-Colonel C. J. Martin, Pathologist to the Hospital, I am deeply grateful for much help. My thanks are due also to his assistants in the laboratory, Captain Kellaway and Sister Williams, and to my colleagues on the medical staff, under whose care many of these cases were, for opportunities of studying their cases.

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[6] Nathan Laxrier. Quoted in an article on Bilharziosis, by Mathias Noc and Léger in Grall and Clarac, "Traité pratique do Pathologie exotique clinique et thérapeutique, 1913."
[7] Zweifel. *Arch. f. Schiff. u. Tropen Hygiene*, 1911, p. 73.
[8] Bassett-Smith. *Brit. Med. Journ.*, 1912, vol. ii, p. 1208.
[9] Edgar. *Journ. State Med.*, September, 1913, vol. xxi, No. 9, p. 542.
[10] Sandwith. "The Medical Diseases of Egypt," 1905, part i, p. 225.
[11] Archibald. *Brit. Med. Journ.*, 1914, vol. ii, p. 297.

ON THE INCUBATION PERIOD OF MUMPS (INFECTIOUS PAROTITIS).

By Captain HAROLD ORR.

Canadian Army Medical Corps.
Sanitary Officer of a Canadian Division.

Although there is considerable literature dealing with the clinical complications of infectious parotitis, and its general epidemiological features have been summarized in Hirsch's classical treatise,[1] comparatively few data are available respecting the incubation period of the disease. The explanation is no doubt to be found in the habitually mild course of the disease in comparison with that of most of the zymotics, which deprives mumps of much practical importance in civil life. From the point of view of the army medical officer, mumps may, however, readily become a real source of inconvenience, and I have thought it desirable to place on record some observations I have had the opportunity of making.

The most extensive collection hitherto published is that of the Clinical Society of London,[2] contained in the report of their committee on incubation periods. Twelve cases are recorded in which there was but a single exposure to infection. The average interval between exposure to infection and the occurrence of pathognomonic signs was 20·9 days. In two instances the date upon which the patient became indisposed, prior to swelling of the parotid, is given, and was eleven days in one and eighteen days in the other. A further series of ninety-two cases is provided showing the date of onset counting from the last exposure. Here the mean interval works out to 18·5 days. There is no necessary discrepancy between these two averages since the latter series can only furnish the minimum incubation period, the length of the exposure prior to the date from which the interval is reckoned not being recorded. Clement Dukes[3] quotes a series of ninety cases, in sixty-nine of which a definite exposure was ascertained. The average incubation period in this series was between eighteen and nineteen days, with a minimum of thirteen and a maximum of twenty-five days. Hudelo[4] cites (without references) Rendu as an authority for placing the incubation period between eighteen and twenty days; he also says that Roth found an incubation period of exactly eighteen days in three cases, and other physicians have observed so short an incubation period as eight and so long a one as thirty days.

Bettelheim[5] reported a short but interesting series. He was medical officer in charge of a battalion 560 strong, forming part of the Austrian Army of occupation of Herzgovina in 1882, and was stationed in the remote and isolated township of Ljubinje. Two cases of typical mumps occurred on June 14 and June 16 in an officer and a private forming part of a detachment occupying a still

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[1] Hirsch's "Handbook of Geographical and Historical Pathology," English Translation, vol. iii, p. 277.

[2] *Clinical Society's Transactions*, vol. xxv, 1892 Supplement, p. 107.

[3] *Lancet*, 1881, p. 743; 1899, p. 1147.

[4] L. Hudelo, "Les Oreillons," Brouardel and Gilbert's *Nouveau Traité de Médecine*, Paris, 1905, fascicule ix, p. 81.

[5] *Weiner Med. Wochenschr.*, 1883, p. 1220.

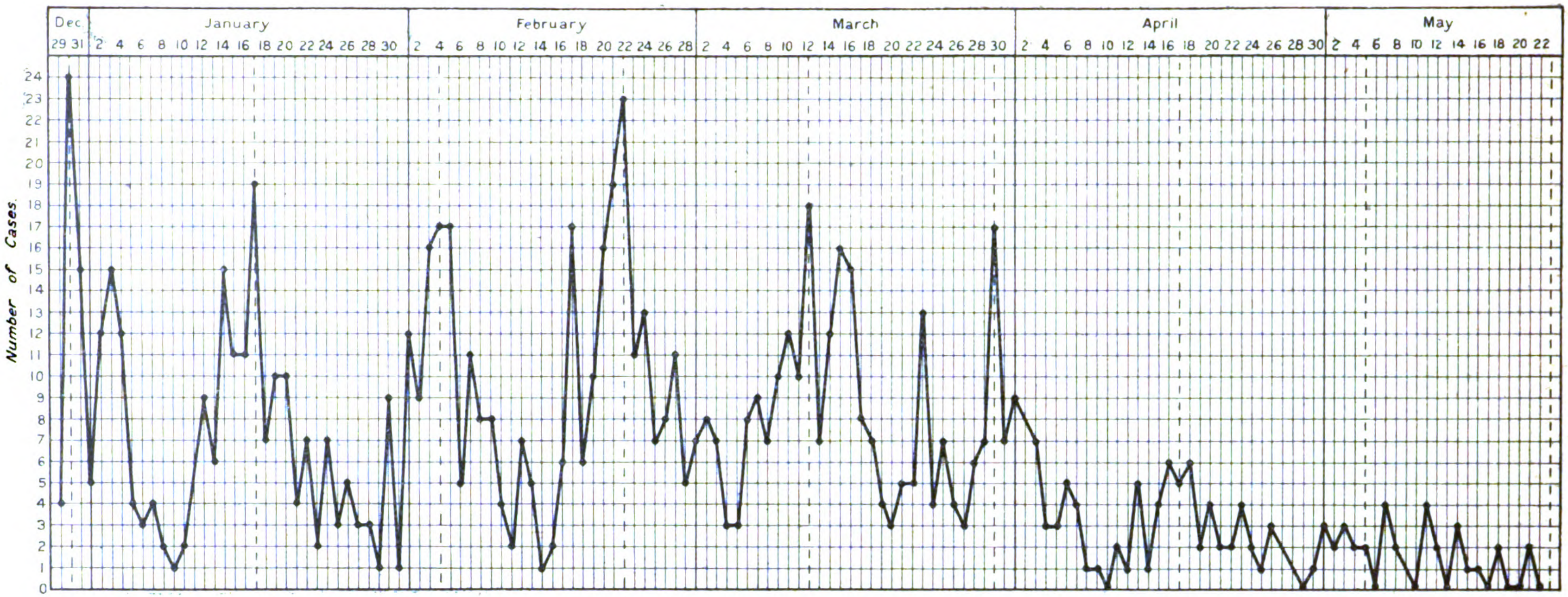

Chart showing number of cases of mumps occurring daily.

more isolated situation. After the detachment had been relieved and returned to Ljubinje two more soldiers of the same unit developed mumps on July 8 and July 9. No further cases occurred. These results suggest an incubation period of about twenty days. Bloomfield[6] has reported a case of mumps developing twenty-five days after a solitary exposure, while Penny[7] has recorded a small epidemic at Marlborough School. The first case was on May 6, a week after the term began; the next case was on June 1, there was another on June 3, and ten more between June 18 and 27. These are the only dated records I have found, the figures quoted in current text-books being for the most part derived from the Clinical Society's statement. It appears then that the limits are between eight and thirty days or rather more, observations clustering around the eighteenth to twentieth days.

My own observations relate to a camp in Surrey occupied by a mobilized division of approximately 18,000 men. Prior to December 29, 1916, there had been a few sporadic cases of mumps, but never more than one or two on any one day. On December 29 two battalions which had been exposed to mumps arrived in camp, and within thirty-six hours twenty-eight cases of mumps were admitted to hospital from these battalions. The epidemic, therefore, in so far as this camp was concerned, had a definite beginning on December 30, when twenty-four cases occurred. It lasted until the following May, during which time 902 cases occurred.

The course of the epidemic is illustrated graphically in the accompanying diagram. In addition, at the suggestion of Major Greenwood the daily returns are given in the accompanying table.

Both from the diagram and the table it will be seen that the maxima recurred with remarkable regularity at intervals of eighteen days. While the maxima are repeated at regular intervals (that there were actually as many cases on February 5 as on February 4 may be explained by the circumstance that the latter date fell upon a Sunday with the result that many cases were concealed until the following day) there is not a complete correspondence between intermediate returns for days occupying corresponding positions in the cycle. For example, for the cases occurring on May 15, 16, and 23 there is not a corresponding number of cases occurring eighteen days previously or eighteen days later. This might be due to two things: (1) The epidemic might be strictly periodic, an eighteen days' cycle being one component, but other components might also be present; (2) the eighteen days' cycle might be the only harmonic component, irregularities being due to accidental extraneous circumstances.

To test the former hypothesis I have utilized the method of the periodogram,[8] which has been recently employed with success by Brownlee[9] in the elucidation of epidemic diseases. It is known that when a series of numbers which are really periodic is written down in rows and columns the difference between the greatest and least of the columns summed vertically will be the largest when the number

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[6] *Brit. Med. Journ.*, 1905, i, p. 412.

[7] *Ibid.*, 1904, i, p. 489.

[8] See Carse and Shearer's "Course in Fourier's Analysis and Periodogram Analysis," Edinburgh Mathematical Tracts, London, Bell, 1915.

[9] *Public Health*, vol. xxviii, 1915, p. 125.

of items in each row corresponds to the period. Thus if the period is of six terms and we write down the observations in rows of six, the seventh observation being vertically below the first, and so on, the difference between the greatest and least of the vertical sums will be larger than when the process is with either five or seven items in each row. By summing the observations in rows of five, seven, etc., it is possible to isolate particular periodic constituents from data containing more than one. If for instance the series contains a period of 6 and also one of 11, the oscillation (i.e., the difference between the largest and smallest vertical sum) will decrease as we pass away from 6 and increase again as we approach 11 items to the row.

SUCCESSION OF CASES.

Date	Number of cases	Date	Number of cases	Date	Number of cases	Date	Number of cases
Dec. 29	4	Feb. 3	16	March 11	10	April 16	6
,, 30	24	,, 4	17	,, 12	18	,, 17	5
,, 31	15	,, 5	17	,, 13	7	,, 18	6
Jan. 1	5	,, 6	5	,, 14	12	,, 19	2
,, 2	12	,, 7	11	,, 15	16	,, 20	4
,, 3	15	,, 8	8	,, 16	15	,, 21	2
,, 4	12	,, 9	8	,, 17	8	,, 22	2
,, 5	4	,, 10	4	,, 18	7	,, 23	4
,, 6	3	,, 11	2	,, 19	4	,, 24	2
,, 7	4	,, 12	7	,, 20	3	,, 25	1
,, 8	2	,, 13	5	,, 21	5	,, 26	3
,, 9	1	,, 14	1	,, 22	5	,, 27	2
,, 10	2	,, 15	2	,, 23	13	,, 28	1
,, 11	6	,, 16	6	,, 24	4	,, 29	0
,, 12	9	,, 17	17	,, 25	7	,, 30	1
,, 13	6	,, 18	6	,, 26	4	May 1	3
,, 14	15	,, 19	10	,, 27	3	,, 2	2
,, 15	11	,, 20	16	,, 28	6	,, 3	3
,, 16	11	,, 21	19	,, 29	7	,, 4	2
,, 17	19	,, 22	23	,, 30	17	,, 5	2
,, 18	7	,, 23	11	,, 31	7	,, 6	0
,, 19	10	,, 24	13	April 1	9	,, 7	4
,, 20	10	,, 25	7	,, 2	8	,, 8	2
,, 21	4	,, 26	8	,, 3	7	,, 9	1
,, 22	7	,, 27	11	,, 4	3	,, 10	0
,, 23	2	,, 28	5	,, 5	3	,, 11	4
,, 24	7	March 1	7	,, 6	5	,, 12	2
,, 25	3	,, 2	8	,, 7	4	,, 13	0
,, 26	5	,, 3	7	,, 8	1	,, 14	3
,, 27	3	,, 4	3	,, 9	1	,, 15	1
,, 28	3	,, 5	3	,, 10	0	,, 16	1
,, 29	1	,, 6	8	,, 11	2	,, 17	0
,, 30	9	,, 7	9	,, 12	1	,, 18	2
,, 31	1	,, 8	7	,, 13	5	,, 19	0
Feb. 1	12	,, 9	10	,, 14	1	,, 20	0
,, 2	9	,, 10	12	,, 15	4	,, 21	2

Illustrating this on the present data, we have for the oscillation when the horizontal row consists of 18 items, 108. The distribution about the maximum is roughly symmetrical. Thus the maximum is 125, the sum of the columns on either side of it 75 and 70, the next two corresponding sums are 60 and 63, etc. If the horizontal row consists of 19 or 17 terms, the oscillation sinks to 61 or 56.

A search has been made in this way for other periods. There is a slight suggestion of a period of between twelve and thirteen days, the oscillation

decreasing sharply from thirteen to fourteen horizontal items; this might possibly correspond to the type of short incubations mentioned in the literature, but the series, although a long one, is hardly long enough for the isolation of periods by the summation method to be quite satisfactory unless the change of oscillation is much more considerable than has been found to be the case. A second process which is readily applicable to astronomical data, for which the periodogram method is largely used—viz., subtraction of the ascertained periodic constituent (here the eighteen days' period) from the series in order to see how far the observations are reproduced—i.e., how little remains unaccounted for—fails because the epidemic is evidently declining in intensity, so that a simple *sine* series could not be used.[10] I am not confident, therefore, that any other period than the one of eighteen days exists.

Reverting to the second suggestion of external disturbing factors, it is to be noted that during the last week in February the disease was introduced for the first time into a very susceptible rural battalion with the result that an exceedingly large number of cases developed eighteen days later, all the susceptible men in the battalion apparently contracting the disease as the result of contact with the first cases to appear. There were other disturbing elements such as susceptible men being brought into the area from time to time, and also concealment of the disease during week ends and holidays.

The chief point brought out is the existence of an eighteen days' cycle as a chief component of the epidemic. Assuming this to represent a phase of the life cycle of the causative organism, it is seen to be maintained through several generations.

I wish to thank Major M. Greenwood, R.A.M.C., for the interest he has taken in this note, and for his valuable assistance in looking up the literature and affording me several references.

A CASE OF REMOVAL OF A RIFLE BULLET FROM THE RIGHT VENTRICLE OF THE HEART.

By Dr. MARGUERITE WHITE,
Attached Royal Army Medical Corps;
Surgical Specialist to St. Elmo Hospital;
Assistant Surgeon to the Carl Beck North Chicago Hospital Clinic.
AND
Colonel Sir CHARLES BALLANCE, K.C.M.G.
Army Medical Service.

Trpr. M., aged 21, was wounded by a bullet on November 14, 1917. He rode some miles to the nearest dressing station and then collapsed. On examination it was found that the bullet had passed through the upper part of the right arm behind the humerus, and then entered the right chest between the fourth and

[10] The decline of the epidemic might be thought to support the belief that cold and changeable weather is a factor of epidemic prevalence, a view countenanced by the father of medicine, Hippocrates, who described undoubted mumps as epidemic in Thasos at the beginning of spring ("Epidemics," Book I, Chap. I), and partly by Hirsch (*op. cit.*, p. 281). I could trace, however, no connection between the weather and the course of the epidemic, while summer outbreaks have often been recorded (e.g., by Calmette, *Arch. de Gen. Medecine*, 1883, p. 455, in troops at Brest between May, 1877, and April, 1878).

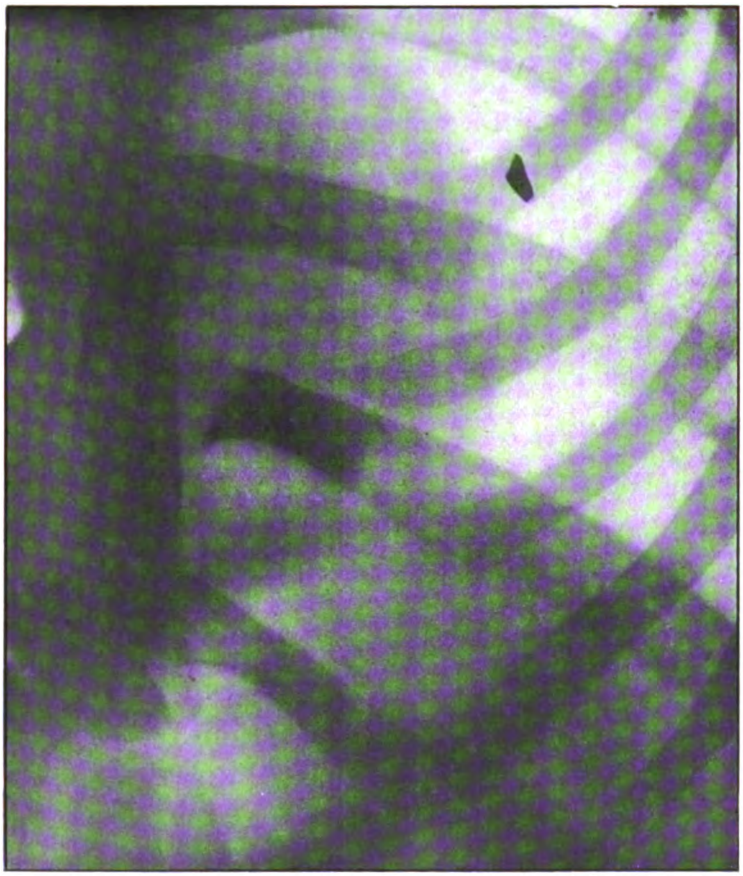


FIG. 1.—Radiogram of position of bullet.

To illustrate "A Case of Removal of a Rifle Bullet from the Right Ventricle of the Heart," by Dr. MARGUERITE WHITE and Colonel Sir CHARLES BALLANCE, K.C.M.G., A.M.S.

fifth ribs and had not emerged. A radiogram taken the next day showed the bullet two inches from the surface in the cardiac region on a level with the inferior border of the heart; the bullet moved with the cardiac pulsations. It was thought to be in the wall of the left ventricle near the anterior margin. There was some fluid at the base of the right pleura.

November 16, 1917.—*Operation* at the 40th Casualty Clearing Station Hospital, Salonika. Transverse incision through upper part of left rectus and exploration of under surface of diaphragm. Nothing abnormal found.

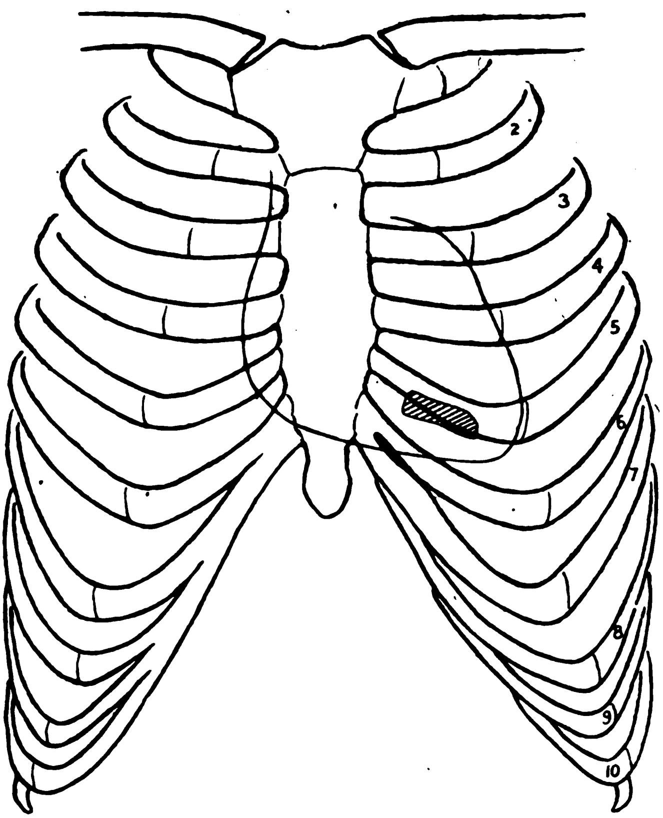


FIG. 2.—Diagram by Captain Crowe, R.A.M.C., of the position of the bullet from X-ray examinations.

Patient was transferred to 63rd General Hospital, Salonika. The abdominal wound was then suppurating. Examination of chest. No pericardial rub. No definite cardiac murmur, small amount of fluid at base of right chest. Left lung normal. X-ray examination confirmed previous report. Bullet still thought to be in left ventricle.

Patient admitted to St. Elmo Hospital, Malta, from Salonika on January 13, 1918, as a cot case.

On Admission.—General condition good. While lying down pulse 96 steady and regular: on exertion, such as getting out of bed or picking up an object off

the floor from the bed, the pulse became irregular and rapid. He was once allowed to cross the ward, when the pulse rose to 130 and the face became pale. The other clinical findings were all negative except for a small goitre which had been present for years. The patient came from Derbyshire. Repeated X-ray examinations, both with the screen and by means of stereoscopic plates were made, with the assistance of Major Campbell, R.A.M.C. (fig. 1). These showed movement of diaphragm independent of the bullet. The bullet lay behind the left fifth cartilage and left fifth intercostal space, ¾ inch from the left border of the sternum and about two inches deep from the skin surface in front. The base of the bullet lay towards the right while the pointed end was directed towards the left and somewhat downwards, and moved more than the base with the pulsations of the heart. It was thought that the base of the bullet was fixed in the wall of the right ventricle and that the pointed end was in the cavity of the right ventricle (fig. 2).

Decision to Operate.—The patient had suffered severely from sea-sickness during the voyage from Salonika and this had caused much distress from palpitation and choking sensations. Further, the rapidity and irregularity of the heart on the slightest exertion and the known position of the bullet made it desirable to perform an exploratory operation in order to determine whether it was possible to remove the bullet. The patient had remained in bed under observation without improvement.

Operation, February 16, 1918.—Lieutenant-Colonel Shirley gave the anæsthetic. Kocher's incision for exposure of the heart was made and the fourth, fifth and sixth costal cartilages of the left side were removed. The internal mammary artery was tied in two places and divided between the ligatures. The triangularis sterni was divided and the border of the left pleura crossing obliquely the front of the pericardium was seen and thereafter held aside with a copper retractor. No iniury to the pleura occurred. The anterior surface of the pericardium appeared normal except for a small puckered scar ½ inch from the left border of the sternum about the level of the fourth space. An incision was made in the pericardium passing obliquely downwards and towards the left and as long as the resection of the chest wall allowed. A very little gas and frothy fluid escaped but no adhesions between the parietal and visceral layer of the pericardium were found. The anterior surface of the heart appeared normal both to sight and touch. One of us (W.) then palpated the posterior surface of the heart and at once felt the bullet through the wall of the right ventricle near the apex. Five stitches of No. 1 silk were then passed close to the apex of the heart along the anterior inter-ventricular groove. Near the apex the groove was somewhat obscured by fat and the stitches passed through both muscle and fat. These threads were used to pull the apex of the heart forwards and upwards; a first-rate exposure of the posterior surface was thus obtained. On the posterior aspect of the heart no scar was visible and no bulging was seen. Palpation determined that the bullet was lying near the apex of the heart on the right side of the posterior inter-ventricular groove and was apparently in the ventricle. Four silk stitches were next inserted in the wall of the right ventricle along the line of the proposed incision; they passed twice through the muscle so that the loop could be drawn out of the way while the incision was being made. One of us (B.) then seized the heart with the left hand, using the thumb to compress the

right ventricle above the line of the proposed incision. It was found difficult to cut the quickly contracting heart muscle with the knife, so the incision into the ventricle was completed with scissors. B. then introduced a pair of artery forceps into the cavity of the right ventricle through the incision, seized the free extremity of the bullet and pulled it outside the heart. In doing so the inner surface of the ventricular wall was everted, exposing the columnæ carneæ, because the base of the bullet was firmly embedded and attached to this surface. W. then with a knife cut the inner aspect of the ventricular wall and the bullet was free. The hæmorrhage was fairly profuse but was at once controlled by

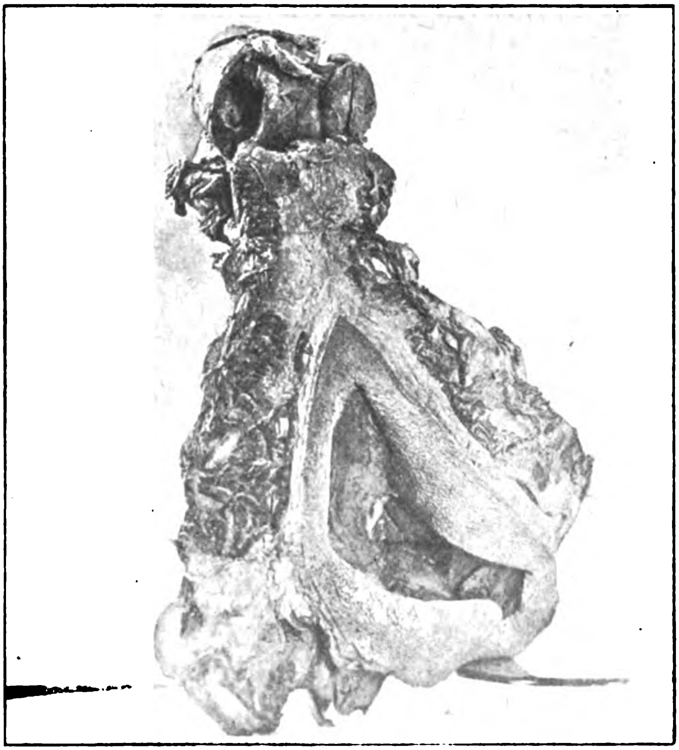


Fig. 3a.—Photograph of front view of parts removed at the autopsy. Below is seen the heart and pericardium. A portion of skin surrounding the wound has been left in situ. Above is seen the abscess cavity in the right lobe of the thyroid gland.

pulling on the stitches which had already been passed, and by putting in four more so as to invert, Lembert-like, the outer wall of the ventricle. The manipulation at no time affected the work of the heart, and the pulse only failed momentarily when blood was escaping from the heart. There was no visible sign of inflammation or sepsis. The pericardium was filled with saline and stitched up. The superficial incision was also closed and the patient returned to bed without shock. Colour good, respiration 20, pulse 110. Throughout the operation the blood-pressure was carefully noted.

Course of the Case.—For three days the condition was encouraging. On the fourth day some emphysema was noted on the upper part of the left side of the gladiolus and in the afternoon of that day there was serious collapse, from which the patient rallied after strychnia and oxygen had been given and mustard baths applied to the extremities. That night he was very restless, complained of pain in the chest, and had an irritating cough with choking sensations. Next day (February 21) while coughing, a large quantity of clear fluid of a yellow colour, and somewhat sticky and albuminous, escaped from the wound. He became unconscious and pulseless; strychnia and oxygen were again given, ether

FIG. 3B.—Photograph of front view of parts removed at autopsy. Same as fig. 3A, but enlarged, and not showing thyroid gland.

injected subcutaneously and mustard baths applied to the extremities. The patient revived, and in half an hour asked for his breakfast. Pulse 90, strong and regular. Breathing deep and easy, all pain gone. Profuse drainage from wound. On February 24 the discharge from the wound was definitely purulent, the skin flap was opened up, and the next day all stitches in the pericardium were removed, and the pericardial cavity, which contained pus, was irrigated with saline solution.

The subsequent history is that of progressive sepsis, with free discharge from the wound, and although the patient was carefully tended and was twice transfused, he died on March 14.

Autopsy.—Wide gaping wound in precordial region; large opening in pericardium; considerable area of anterior aspect of heart exposed. Petechial hæmorrhages subcutaneously and over some of the viscera. Liver, nutmeg mottling on sections. Spleen, somewhat enlarged. Kidneys, numerous minute abscesses and cloudy swelling of cortex. The thoracic viscera were taken away entire and preserved in ten per cent formalin for further examination. After

FIG. 4.—Posterior view of intrathoracic thyroid lobe, and above is seen the abscess cavity. Below the tissue is solid with some cysts of small size.

fixation: Both lungs normal. No enlarged glands in hilum of either lung or in mediastinum; the latter was normal. Œsophagus, trachea and main bronchi normal. The right lobe of the thyroid extended downwards some distance, indeed to the bifurcation of the trachea. This enlargement and extension downwards of the right lobe of the thyroid pressed the trachea towards the left, giving it a definite curve in that direction. At the back of the right lobe of the thyroid was a cyst $1\frac{1}{2}$ inches in diameter containing pus, below the cyst was more thyroid tissue which extended to the bifurcation of the trachea. The thoracic lobe was $2\frac{1}{2}$ inches long by $1\frac{1}{2}$ inches wide and was circular on horizontal section. On

section numerous cysts were seen, many of which contained pus. In parts the interstitial tissue contained calcareous matter.

The pericardium was opened from behind, it was lined by a thick adventitious membrane, the visceral layer was everywhere intact but thickened, and some petechial hæmorrhages were seen. The line of incision at the back of the right ventricle was not visible but two or three puckers on the surface of the heart gave some indication of the site of operation. The operation incision had to the

FIG. 5.—Posterior view of heart showing the healed line of incision. This is indicated by the projecting ends of some of the sutures.

naked eye apparently healed. Microscopic sections through site of incision in ventricular wall showed the line of incision occupied by young connective tissue and evidence of pus at the surface; other sections showed encapsulation of ligature and changes in the cardiac muscle near the incision.

NOTE BY PROFESSOR S. G. SHATTOCK, F.R.S., ON THE MICROSCOPIC SECTIONS.

In the myocardium about the line of incision there is a well-pronounced formation of fibroblastic tissue which in some spots appear to have united certain of the muscular fasciculi, and in others not.

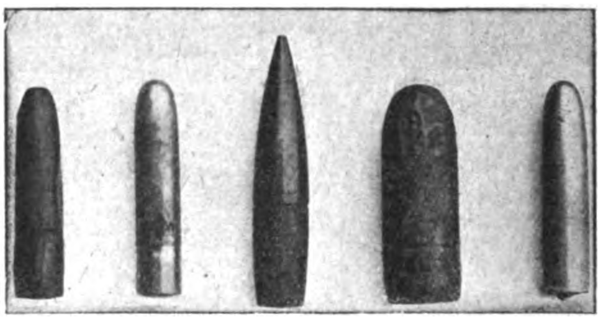
In the neighbourhood and in the line of the injury there is a somewhat widespread fibrino-purulent exudate containing several colonies of staphylococcus.

It may be observed that secondary hæmorrhage would have been likely to take place if the patient had lived longer, as the wound was so imperfectly healed and so acutely infected.

Remarks.—We have in the first place to express our thanks to Colonel Sir Archibald Garrod for the constant help he gave us in the management of the case. With regard to the course of the bullet the scar on the front of the pericardium and the fact that the bullet was deformed and must have been spent, make it probable that it passed forwards and downwards through the right chest, struck the back of the gladiolus and was thus deflected backwards through the pericardium and into the heart. We are publishing the case in full for the sake of those who, in the future, may have to operate on bullet wounds of the heart. Looking back upon the case we think it would have been pure luck if recovery had ensued and thus some other surgeon reading a glorified account of the case might have followed our methods and met with disaster. While the operation was carried out in many respects on the ordinary principles of surgery, treating the heart muscle like any other tissue of the body, the after-treatment was not in its early stages so conducted. When the patient became ill, instead of treating the case on ordinary principles and opening the lines of incision, we were absorbed in dreams and idle speculations, one of which was that clot was forming on the wound in the interior of the right ventricle and that its extension was embarrassing the action of the heart. It is a common experience that bullets frequently lodge in the tissues and induce neither local nor general infection until attempts at removal are made. The total absence of adhesions or any visible sign of inflammation in the pericardium and heart led us to close the wound in the pericardium, which was a fatal mistake. Further, on opening the pericardium we had observed a little gas and frothy fluid which notwithstanding all the other appearances must have been pathological, so that looking back we may affirm that there was no valid excuse for closing the pericardium. We were so little experienced in viewing large areas of the living heart that we had an instinctive desire to close the wound quickly and get it out of sight as soon as possible. As a matter of fact the pericardium and superficial wound should have been left widely open as if the operation had been done for suppurative pericarditis. The question of possible sepsis was ignored and further, in order not to leave any air in the pericardium, which might have caused surgical emphysema, it was filled to the brim with normal saline solution, and we believe that this must have embarrassed the heart and promoted sepsis, for though no absorption took place we are convinced that the amount of fluid was considerably increased by secretion. We do not know the normal amount of fluid in the pericardium in health, but we do know that it was a mistake to distend the pericardium with fluid, especially as we were in total ignorance of the absorbing power of the pericardium. We fancy that none of the fluid introduced was absorbed, and that being under pressure it was one of the prime factors in the early stages of the septic process. When the patient became ill on the fourth and fifth days and we were anxious about him, though the temperature was not above 99° F., there was no bulging forwards of the pericardium under the skin flap. This rather led the mind away from the pericardium to possible other causes of the condition. It was forgotten that the pericardium is an inelastic white fibrous membrane and could not possibly bulge forwards beyond its anatomical limits. The appearances during operation were so apparently normal that the bullet on removal was not, as it should have been, dropped into a culture medium. In the course of the case it appeared reasonable to assume that an abscess might form in the posterior mediastinum. The

lymphatics of the pericardium we believe go to the bronchial lymph glands, but we could not obtain a modern book of reference, such as Porier and Charpy, or Testut, on Anatomy. The Rector of the University, Professor Maqro, kindly gave us a cadaver to practise the operation of opening the posterior mediastinum. We

British, 175 grs. 1914. — German, 154 grs. 1914. M. — Turkish, 154 grs. 1915. M. — Turkish, 214 grs. 1912. M. — Italian, 154 grs. 1915. — Bulgar, 244 grs. 1903. M. — Bulgar, 212 grs. 1916. — Bulgar, 344 grs. M. 1903.

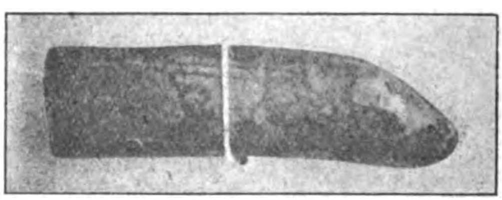


Serbian, copper, hollow, 36 grs., old pattern. — Serbian, 159 grs. 1915. M. — French, copper, 190 grs. 1914. — Lead, 520 grs. Picked up on field, Salonika. Nationality (?) — Greek, 174 grs. 1915. M.

The one marked with a cross was taken out of right ventricle of a man's heart at St. Elmo Hospital, Malta.

M. means magnetic.

Various types of bullets, showing which are and which are not magnetic.



Bullet (deformed and enlarged).

FIG. 6.

found that the removal of about two inches of the sixth and seventh ribs commencing two inches from the spines of the vertebræ enabled us to reflect the parietal pleura without injury or difficulty and to enter the mediastinum. In this body the posterior surface of the pericardium was five inches from the skin surface of the back.

Before operation we obtained bullets of different nations to see whether a magnet would be useful in removing the bullet from the patient. It was probable, indeed certain, that the bullet lodged in the patient was projected from a Bulgarian rifle as the only prisoners taken in the action in which this soldier was wounded were Bulgarians. The modern Bulgarian bullet tested by us was not magnetic, while the modern Serbian bullet proved strongly magnetic. We therefore did not have in the theatre the powerful electro-magnet made for us by the Royal Engineers. After removal the bullet proved to be an old Bulgarian bullet and was strongly magnetic (fig. 6).

Seeing that the patient had a goitre we ought to have studied this tumour by radiography before doing the heart operation. It would then have been discovered that there was an intra-thoracic lobe, and it might have been decided to remove this before operating on the heart. The cavity of this lobe might have been recognized, and the displacement of the trachea would certainly have been ascertained by an X-ray examination. The question also arises, was pus present in the thyroid before operation, and if not what is the lymphatic connexion between the pericardium and the thyroid gland?

It was impossible to drain the pericardium by placing the patient in the prone position as the heart then immediately blocked the exit from that cavity. At one time we thought that an abscess was forming in the posterior mediastinum, because of intermittent discharge of pus from the left side of the posterior part of the cavity; this portion being inaccessible to visual examination we could not judge what was going on there, as we could in all other regions of the pericardium. We, indeed, almost hoped that an empyema would form in the left pleura, because then it would have been possible to drain the empyema and at the same time to make an incision in the pericardium far back on the left side. We were familiar with a case of suppurative pericarditis in which this operation was done, and the patient recovered. But in this heart case no empyema occurred and no extension to the mediastinum; indeed, the thick strong wall of the pericardium could not easily or quickly give way to softening or perforation by the action of pus. We may mention that vaccines were used, but were of no avail. The use of a small soft rubber catheter with its point behind the heart, for continuous irrigation of the pericardium, caused no disturbance of the heart's action. In Kocher's operation the cartilages are divided at their inner extremities and displaced outwards with the flap. This seemed undesirable, and a less simple procedure than removal, hence in this case the cartilages were taken away. During the War several cases have been recorded of operations on the heart, in the *Daily Review of the Foreign Press*, and elsewhere. The difficulty of dealing with suppurative pericarditis is emphasized in the story of these cases. Other instances in which operation has been done are recorded, but the final result has not been stated. We think, therefore, that the publication of a fairly full account of this case may be useful to our fellow-workers.

Abstract of the Daily Notes of the Case.

February 16, 1918.—Operation.

February 17.—Patient vomited for twenty-four hours after the operation; somewhat restless; was given morphia and strophanthus; temperature 98·6° F.; pulse 110, good quality.

February 18.—No sickness; slept all night; very comfortable; pulse 120, rather high tension; temperature normal; heroin and strophanthus, two doses given during the day; taking nourishment well.

February 19.—Slept all night; pulse 138, soft, missing one every six beats; taking nourishment well; temperature normal.

February 20.—Slept well; pulse 128, missing one every third beat; respiration 24; colour good; patient apparently very well; doubtful extension of pericardial dullness to right; some emphysema on upper part of left side of gladiolus. 12 noon: Temperature 100° F.; pulse 120; breathing laboured and shallow; extremities cold; perspiring profusely; very thirsty. 3 p.m.: Temperature 98° F.; pain in left side of chest and very restless. 5 p.m.: Serious collapse; face and limbs cyanotic; no radial pulse; strychnia and oxygen given and mustard baths to the extremities. 7 p.m.: Patient much better; good colour; pulse 120; temperature 99° F.; respiration 38; heroin and strophanthus given.

February 21.—Very restless night; temperature 99° F.; pulse very feeble; breathing difficult; pain in left side of chest; irritating cough and choking sensations. 11 a.m.: While coughing a large quantity of clear fluid of a yellow colour and somewhat sticky and albuminous in character escaped from the wound; patient became unconscious and pulseless; strychnia, oxygen, ether subcutaneously, hot mustard baths to the extremities revived the patient; in half an hour patient asked for his breakfast; pulse 90, strong and regular; breathing deep and easy, all pain gone; profuse drainage from wound. 3 p.m.: Has slept three hours; is very comfortable; blood-pressure 120.

February 22.—Temperature 101° F.; pulse 90, good volume and regular; taking food well. Morphia ¼ grain given in evening.

February 23.—Wound draining considerable quantities of clear serous fluid; temperature 101° to 102° F.; eusol compresses; some of the superficial stitches removed.

February 24.—Temperature 102° F.; pulse 120; respiration 30 to 40 when awake, 24 when asleep. Some more stitches removed; fluid turbid, very free drainage. 7 p.m.: Some pus coming from wound; skin flap opened up, exposing a gangrenous cellulitis beneath; irrigation with eusol. There is no obvious opening in the pericardium—the incision seemed closed entirely; eusol pack to wound; this was frequently changed.

February 25.—9 a.m.: Temperature 100·8° F.; pulse 120, regular. There is now an opening in the pericardium; through this opening thin purulent fluid in pericardium was washed out by means of a catheter and eusol. 3 p.m.: All the pericardial stitches were removed, and the whole length of the line of incision in this membrane was opened and the cavity irrigated with saline solution. 9 p.m.: Temperature 101° F.; pulse 130, irregular; respiration 40, when asleep 26.

February 26.—Has had a very restless night, with pain in chest and feeling of faintness. Temperature 100·2° F.; pulse 112; respiration 34. 9 p.m.: Pulse irregular and rapid; has been given morphia and strophanthus. Pericardium washed out every eight hours by pouring a jugful of eusol slowly into the pericardium.

February 28.—Not so well; breathing shallow; complains of fullness in the chest; diarrhœa; pulse rapid and irregular; much pus coming from pericardium,

especially from left posterior region which could not come under observation like other parts of the cavity.

March 1.—9 a.m.: Left chest normal, right chest dull behind up to level of fifth rib. Temperature 104° F.; pulse 128; respiration 38. Query—Empyema on right side from continuity of infection from pericardium; right chest exploratory puncture, clear fluid removed which proved sterile. The examination of the pericardial pus showed the presence of *Streptococcus pyogenes*, *Staphylococcus aureus* and a *long thin bacillus* which was *gas producing* and which Major Russell could not identify. Blood films negative to malaria.

March 2.—Temperature 104° F.; pulse 128; breathing better; œdema of left foot; the pus from the pericardium is less in quantity and the question arose, was it escaping into the mediastinum?

March 3.—Patient's condition unchanged. Right chest aspirated, twelve ounces of clear fluid removed which proved sterile; temperature still 104° F.

March 4.—The temperature dropped to 101° F. in the evening, respiration 24; wound outside pericardium quite healthy; complains of bad taste in the mouth; dyspnœa, dysphagia, and pains on left side of chest.

March 5.—Leucocytes count 4,500; temperature during night dropped suddenly to 97° from 104° F.; patient much collapsed; much pus suddenly escaped from pericardium, probably a local collection behind the heart; incontinence of fæces and urine. 9 p.m.: Temperature 100° F.; pulse 120; taking food well; dyspnœa and dysphagia absent.

March 6.—In the effort to check the sepsis it was decided to do direct transfusion of blood. Major Russell had previously selected a donor whose blood was homologous to that of the patient; patient looks very anæmic and is very feeble; temperature 100° F.; pulse uncountable and irregular. While the donor's artery was being anæsthetized with eucaine he fainted, the blood-pressure fell to 90 and the transfusion of blood became impossible. The patient was then infused with Oii of normal saline to which was added ℥iiss of brandy and six cubic centimetres of a 1 in 1,000 perchloride of mercury solution.

March 7.—Very good night; pulse still irregular, volume better; taking nourishment well. 9 p.m.: Saline infusion repeated with ℥iii of brandy and seven cubic centimetres of 1 in 1,000 solution of perchloride of mercury. There is phlebitis of external saphenous vein of left leg.

March 8.—Urine shows for the *first time albumin*, casts and pus; autogenous vaccine given. General condition slightly improved. Temperature 100° F.; pulse 100.

March 9.—Temperature 102·6° F.; pulse 96, regular; sweating a good deal; taking food well. Large quantity of pus coming from pericardium, the amount of pus seems stationary; the cavity is still irrigated every eight hours with eusol.

March 10.—Patient very anæmic and weak; petechial cutaneous hæmorrhage at various places. Temperature 101° F.; pulse 120. Blood transfusion decided on; hæmoglobin, fifty-eight per cent; leucocyte count, 4,500. 8 p.m.: The transfusion apparatus of Bazett was employed. On dissecting out the radial artery of the donor it was found extraordinarily small—it was obvious that the radial artery had divided higher up the forearm. The operation was, however, continued; but the stream of blood from the small artery of the donor was

unsatisfactory, and it was thought that not more than 300 cubic centimetres had passed into the vein of the patient; nevertheless, the colour of the patient improved and the pulse dropped from 130 to 90.

March 11.—Leucocyte count, 12,700; hæmoglobin, sixty-eight per cent. Thus a marked improvement in the condition of the blood was effected by yesterday's transfusion. Patient very weak and feeble, but colour better. Temperature 99° to 101° F.; pulse varies from 90 to 120. Much pus from pericardium; continuous irrigation with eusol. Strychnine and digitalis every three hours; glucose ℥ v, brandy ℥ i, every four hours per rectum.

The patient's condition remained very grave till his death on March 14. Another transfusion of blood was carried out on March 12: a large quantity of blood passed from the donor to the patient; the operation was continued till the blood-pressure of the donor fell to 90. Blood was passing from the donor for 5½ minutes. The red count previous to the transfusion was 1,500,000. Major Russell estimated next day that two out of every three red blood corpuscles in the patient's blood had come from the donor. The last two days the temperature was normal or 99° F., and consciousness was present to the last.

Report.

AN INVESTIGATION INTO THE INCIDENCE OF ALBUMINURIA AND CASTS IN BRITISH SOLDIERS DURING TRAINING AND THE RELATIONSHIP OF THIS CONDITION TO WAR NEPHRITIS.

By Captain H. MacLEAN.
Royal Army Medical Corps.

Report to the Committee on War Nephritis.

(The Medical Research Committee provided the services of Captain H. MacLean.)

(Concluded from p. 426.)

TABLE LIII.—Incidence of Casts in Different Age Periods in Fourth Group of 10,000 Men Examined.

Age period	Number of men in each period	Number of men with casts in each period	Average per 1,000
19 to 23 years inclusive ..	3,789	80	21
24 ,, 28 ,, ,, ..	2,344	54	23
29 ,, 33 ,, ,, ..	1,672	34	20
34 ,, 38 ,, ,, ..	1,244	28	22
39 ,, 43 ,, ,, ..	883	14	16

TABLE LIV.—Relation of Age to Incidence of Albuminuria in Fifth Group of 10,000 Men Examined.

Age	Number of men of given age in group examined	Number of men of given age with albumin	Percentage of men with albumin at different ages
18	26	4	16·0
19	1,036	122	12·0
20	824	64	7·7
21	748	65	8·7
22	730	44	6·0
23	658	28	4·2
24	573	37	6·5
25	525	41	7·8
26	490	30	6·1
27	416	17	4·1
28	413	22	5·3
29	396	29	7·3
30	399	22	5·5
31	310	22	7·1
32	279	18	6·4
33	280	14	5·0
34	228	9	4·0
35	230	12	5·2
36	222	11	4·9
37	196	12	6·1
38	206	9	4·4
39	171	11	6·4
40	170	5	2·9
41	143	7	4·9
42	123	9	7·3
43	66	4	4·0
44	26	2	8·0
45	17	—	—
46 and over	52	2	4·0

TABLE LV.—RELATION OF AGE TO WELL-MARKED ALBUMINURIA (A, B, C, D GRADES) IN FIFTH GROUP OF 10,000 MEN.

Age	Number of men in group	Number of men with well-marked albuminuria in group	Percentage of men with well-marked albuminuria in each group
18	26	2	6·0
19	1,036	71	6·8
20	824	28	3·4
21	748	37	4·9
22	730	20	2·7
23	658	14	2·1
24	573	15	2·6
25	525	21	4·1
26	490	21	4·3
27	416	10	2·4
28	413	11	2·6
29	396	18	4·5
30	399	7	1·8
31	310	11	3·5
32	279	6	2·1
33	280	8	2·9
34	228	4	1·8
35	230	3	1·3
36	222	4	1·8
37	196	7	3·5
38	206	4	1·9
39	171	6	3·5
40	170	—	—
41	143	3	2·1
42	123	6	4·8
43	66	2	3·0
44	26	1	3·9
45 and over	69	1	1·4

TABLE LVI.—INCIDENCE OF TOTAL ALBUMINURIA AND OF WELL-MARKED ALBUMINURIA (A, B, C, D GRADES) IN FIFTH GROUP OF 10,000 MEN IN DIFFERENT AGE PERIODS.

Age period	Number of men in each period	Total albuminuria		Well-marked albuminuria	
		Total number of men suffering from albuminuria of all grades in each period	Average per 1,000	Total number of men suffering from well-marked albuminuria (A, B, C, D grades) in each period	Average per 1,000
18 to 22 years inclusive	3,364	299	89	158	47
23 ,, 27 ,, ,,	2,662	153	57	81	30
28 ,, 32 ,, ,,	1,797	113	64	53	29
33 ,, 37 ,, ,,	1,156	58	50	26	23
38 ,, 42 ,, ,,	813	41	50	19	23
43 years and over ..	161	8	49	4	25

TABLE LVII.—RELATION OF AGE TO PRESENCE OF CASTS OF ALL KINDS IN FIFTH GROUP OF 10,000 MEN EXAMINED.

Age	Number of men of given age in each group	Number of men of given age with epithelial casts	Number of men of given age with hyaline casts	Total number of men of given age with casts	Percentage of men of given age with casts
19	1,036	7	29	36	3·5
20	824	6	9	15	1·8
21	748	3	17	20	2·7
22	730	7	9	16	2·2
23	658	1	8	9	1·4
24	573	6	8	14	2·4
25	525	3	9	12	2·3
26	490	4	6	10	2·0
27	416	1	2	3	0·7
28	413	—	8	8	1·9
29	396	3	5	8	2·0
30	399	—	6	6	1·5
31	310	2	7	9	2·9
32	279	2	5	7	2·5
33	280	1	2	3	1·1
34	228	1	1	2	0·9
35	230	—	3	3	1·3
36	222	2	1	3	1·3
37	196	4	1	5	2·5
38	206	2	4	6	2·9
39	171	4	1	5	2·9
40	170	2	2	4	2·3
41	143	—	2	2	1·4
42	123	2	3	5	4·0
43	66	—	1	1	1·5
44	26	—	1	1	3·8
45	17	—	—	—	—
46 and over	52	—	1	1	1·9

TABLE LVIII.—INCIDENCE OF CASTS IN DIFFERENT AGE PERIODS IN FIFTH GROUP OF 10,000 MEN EXAMINED.

Age period	Number of men in each period	Number of men with casts in each period	Average per 1,000
19 to 23 years inclusive ..	3,996	96	24
24 to 29 ,, ,, ..	2,417	47	19
29 to 33 ,, ,, ..	1,664	33	19
34 to 38 ,, ,, ..	1,082	19	17
39 to 43 ,, ,, ..	673	17	25

(8) RESULTS OF INVESTIGATION ON RECRUITS AT ALDERSHOT.

After the examination just described was completed at the base, the results obtained seemed sufficiently important to warrant an extension of the investigation to recruits. The purpose of this was to ascertain whether the same incidence of albuminuria existed among newly-joined recruits as was found in the trained soldier.

In order to accomplish this, arrangements were made to examine 10,000 recruits at Aldershot. On proceeding to Aldershot for this purpose, however, I found that it was quite impossible to get sufficient numbers of newly-joined

men, for the majority of the men at this base had already undergone several months' training, and were, indeed, in a general way, comparable with those already examined in France.

Under the circumstances, the original intention had in a measure to be abandoned, but a sufficient number of men was found to throw light on the problem of albuminuria in the recruit.

In all, 10,000 men were examined; the general result of the investigation was similar to that obtained in France.

The two special points considered in this investigation were the relation of albuminuria to (1) length of service and (2) age.

Out of the 10,000 men examined, 2,132 had less than one month's service; some of these had no service at all, while several had only one or two days. Several had a week or more, and a few had two to three weeks.

Of these, 2,132 men, 68 per 1,000 had albuminuria, while 34 per 1,000 had well-marked albuminuria; in 15 per 1,000 casts were found.

These figures agree well with the results obtained in the investigation of the three groups already described, amounting in all to nearly 30,000 men.

In these groups, as already stated, the incidence of albuminuria did not vary to any degree with length of training, and was, for men who had undergone from three to seven months' training, 69 per 1,000 for total albuminuria, 34 per 1,000 for well-marked albuminuria, and 24 per 1,000 for casts. Reference to Table XXVI shows that the figures for other service periods are more or less similar. At Aldershot corresponding figures were found for men who had from one to two months' training. (Table LIX.)

These results indicate that training does not apparently increase the incidence of albuminuria in recruits. This conclusion is in harmony with the general results of this investigation, and from it we may safely argue that the incidence and extent of albuminuria in the Army, as seen during training, is not appreciably greater than it is in civilians of corresponding ages.

As already stated, the incidence of albuminuria in young soldiers examined at Aldershot was found to be lower than that for the corresponding age group in France. The reason of this is not obvious, but may be dependent on the fact that sufficient numbers of men of given age were not available at Aldershot.

The Aldershot investigation, though restricted from lack of material, definitely shows, when considered in conjunction with the investigation in France, that Army life and conditions of service in general during training play no part in inducing kidney deficiency as indicated by the presence of albumin and casts in the urine. The results obtained are given in Tables LIX and LX.

TABLE LIX.—Incidence of Albuminuria and Casts in Recruits and in Men with Little Training.

Period of service	Number of men	Total with albuminuria	Average per 1,000	Total with well-marked albuminuria	Average per 1,000	Total with casts	Average per 1,000
Under 1 month	2,132	144	68	72	34	31	15
Between 1 and 2 months ..	1,361	83	61	31	23	16	12
Men examined in France, with 3 to 7 months	—	—	69	—	34	—	24

TABLE LX.—INCIDENCE OF ALBUMIN AND CASTS IN VERY YOUNG SOLDIERS.

Age	Number of men	Total with albuminuria	Average per 1,000	Total with well-marked albuminuria	Average per 1,000	Total with casts	Average per 1,000
18 to 19 years ..	5,837	392	67	178	30	70	12

(9) SUMMARY OF RESULTS OF INVESTIGATION.

(1) In 50,000 men who had practically completed their training, the incidence of total albuminuria of all kinds was found to be 6·48 per cent. After allowing for cases with pus, spermatozoa, etc., the general incidence came out at 5·62 per cent.

For well-marked albuminuria the numbers were 2·55 per cent for all kinds of albuminuria and 2·19 per cent after allowing for pus, etc.

Roughly speaking, the total incidence of albuminuria unaccounted for by the presence of spermatozoa, pus, and other substances, was about 5 per cent, while the corresponding figure for well-marked albuminuria was only about 2 per cent.

(2) Well-marked epithelial and various kinds of hyaline casts were present in certain urines. Very few blood casts were met with.

Out of the 50,000 men, the average number of urines found to contain casts was 1·87 per cent.; of these, 0·84 per cent had definite epithelial casts, while in 1·03 per cent hyaline casts were found.

(3) The total number of men who had albuminuria together with moderate or often large numbers of epithelial or hyaline casts was 550. Of these, 271 had epithelial casts, while in 278 the casts were of the hyaline variety.

It appears that the minimum number of men suffering from more or less definite kidney disease was 550. It is therefore probable that the "Active Service" part of the Army contains, during training, at least 1·1 per cent of men whose kidneys are inefficient, and who are suffering from some degree of disease.

As far as can be determined by examination of the urine, it can be stated with some confidence that not more than two per cent of men give any definite indication of kidney disease as indicated by the presence of albuminuria and fairly large numbers of casts. Definite signs of disease are found in about one per cent of men.

(4) The albuminuria which is produced by sudden severe exertion passes off on resting, and does not appear to become any more marked with prolonged training than it was at the beginning. There is no evidence that it tends to become chronic.

(5) No relationship between incidence of albuminuria and occupation was found in this inquiry. The number of men investigated from this point of view was only 10,000, and the number of different occupations was so great that no figures of statistical importance were available.

(6) Neither the incidence of albuminuria nor of casts has any tendency to increase as the result of long service. This observation appears to be of great importance in its possible bearing on war nephritis.

(7) As a general rule, the incidence of albuminuria is greater in young soldiers (from 18 to 22 or so) than it is in older men; after 25 it decreases somewhat, and

then remains more or less constant. Indeed, in soldiers over 40 there is a distinct tendency for it to decrease to an appreciable extent.

(8) The investigation at Aldershot gave similar results to those obtained at the base in France.

(9) The general results of this investigation strongly support the view that no injurious effects are produced on the kidney by any of the conditions associated with training for active service; the soldier during training does not appear to be more liable to deleterious kidney effects than is the civilian in ordinary life. From this it would appear that war nephritis is probably not the result of any condition present during training, but is due to some factor which is operative, chiefly, in the fighting area.

For assistance in carrying out this investigation I am indebted to so many people that it is impossible to mention them all by name. I wish, however, to take this opportunity to express my thanks to the commanding officers and adjutants of the local infantry base depots for their great kindness and help in making the necessary arrangements for examination of the men. In the later part of the investigation I was fortunate enough to have the assistance of Captain De Wesselow, without whose help it would have been hardly possible for me to complete the examination. I wish also to express my special thanks to two officers of the R.A.M.C.—Captain Wood and Major Dennis. Captain Wood was in charge of 46 Stationary Hospital, and did everything possible to assist me to get the necessary laboratory accommodation. Major (now Lieutenant-Colonel) Dennis, who was then Assistant Inspector of Drafts, spared no pains to render me all the assistance he could; indeed, I feel that no words of mine can express my indebtedness to this officer, whose help and encouragement at all times did much to make this investigation practicable.

INDEX TO VOLUME XXXI.

C.N. = Clinical and other Notes.

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

July, 1918.

EXTRACTS FROM THE "LONDON GAZETTE."

War Office,
May 18, 1918.

The Government of India has forwarded the following list of Officers, whose names have been brought to notice by Lieut.-Gen. Sir A. A. Barrett, K.C.B., K.C.S.I., K.C.V.O., for valuable services rendered during the operations against the Mahsuds, March—August, 1917:—

Medical Services.

Lieut.-Col. L. Addams-Williams, Royal Army Medical Corps.
Lieut.-Col. P. H. Faulkner, Royal Army Medical Corps.
Capt. J. M. Weddell, Royal Army Medical Corps.

War Office,
May 20, 1918.

The following despatch has been received by the Secretary of State for War from Field-Marshal Sir Douglas Haig, K.T., G.C.B., G.C.V.O., K.C.I.E., Commander-in-Chief of the British Armies in France:—

General Headquarters,
April 7, 1918.

My Lord,—I have the honour to submit the names of the Officers, serving, or who have served, under my command during the period September 25, 1917, to midnight, February 24/25, 1918, whose distinguished and gallant services and devotion to duty I consider deserving of special mention.

I have the honour to be, my Lord,
Your obedient Servant,
D. Haig, *Commander-in-Chief,*
The British Armies in France.

Staff.

Major and Brevet Lieut.-Col. E. Ryan, D.S.O., Royal Army Medical Corps.

War Office,
May 13, 1918.

His Majesty the King has been graciously pleased to approve of the following awards to the undermentioned Officers, in recognition of their gallantry and devotion to duty in the Field:—

Awarded the Military Cross.

Temp. Qmr. and Hon. Lieut. Robert Leslie Masters, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty when a camp and some billets were heavily shelled by the enemy. He at once went to the rescue of some men who had been buried in the ruins of a house, and rendered first-aid. He then organized bearer parties from among his men, and brought in four severely wounded men from the camp. By his disregard of danger, quick decision, and good leadership, he set a splendid example to his men, and rendered valuable assistance to the wounded in the absence of a medical officer.

Temp. Capt. Henry Drummond Robb, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. On his camp and its vicinity being heavily shelled he was compelled to conduct his sick parade along the roads which were at the time under heavy shell fire. He succeeded in leading his wounded cases safely under cover, and later remained behind to attend to the men of a neighbouring unit, which had also suffered some casualties as a result of the intense shelling. His courage and devotion to duty were of the highest order.

Temp. Capt. Samuel Rutherford, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. During a period of sixteen hours he tended the wounded in the front trenches without ceasing. Throughout this period he was exposed to heavy shell fire, and for some considerable time the enemy were within a short distance of the aid post. His coolness and presence of mind inspired all ranks with the utmost confidence.

Mentions in Dispatches.

Mesopotamia.

War Office,
May 11, 1918.

The following names are added to the list of Officers, Warrant and Non-commissioned Officers and Men, Ladies and Civilians whose services have been brought to notice as deserving of special mention by the late Lieut.-Gen. Sir Stanley Maude, K.C.B., Commander-in-Chief, Mesopotamian Expeditionary Force, in his dispatch (published in the *London Gazette*, No. 30233, dated August 15, 1917):—

Capt. A. J. Evans, F.R.C.S.Edin., Royal Army Medical Corps (T.F.).
Temp. Capt. A. T. Gibb, Royal Army Medical Corps.

Corrigenda to "Mentions in Dispatches."

Egypt.

Under Royal Army Medical Corps (p. 802):—
No. 29380 Cpl. (Acting Serjt.) J. E. Aynsley.

Mesopotamia.

Supplement to the *London Gazette*, No. 29810, dated November 1, 1916. Under Royal Army Medical Corps (p. 10618):—
Temp. Hon. Capt. W. R. Thomas, Royal Army Medical Corps.
Supplement to the *London Gazette*, No. 30570, dated March 12, 1918. The name of the undermentioned should read as now stated, and not as previously published. Under Royal Army Medical Corps (p. 3117):—
No. 25648 Serjt. J. H. Jones.

War Office,
May 25, 1918.

The following is a continuation of Sir D. Haig's dispatch of April 7, submitting names deserving of special mention:—

Army Medical Service.

Headquarters Staff.

Lieut.-Gen. Sir A. T. Sloggett, K.C.B., K.C.M.G, K.C.V.O., F.R.C.S., K.H.S.
Major-Gen. C. H. Burtchaell, C.B., C.M.G., M.B.
Major-Gen. Sir W. G. Macpherson, K.C.M.G., C.B., M.B., K.H.P.
Temp. Capt. J. Biggam, M.B., Royal Army Medical Corps.
Major R. B. Black, D.S.O., M.B. (Reserve of Officers), Royal Army Medical Corps.
Lieut.-Col. W. R. Blackwell, Royal Army Medical Corps.
Capt. L. G. Bourdillon, D.S.O., M.C., Royal Army Medical Corps.
Col. H. A. Bray, C.M.G., Royal Army Medical Corps.
Capt. A. D. Child, M.B., Royal Army Medical Corps (Special Reserve).
Col. R. W. Clements, D.S.O., M.B.
Lieut.-Col. (Temp. Col.) H. Collinson, D.S.O., M.B., F.R.C.S., Royal Army Medical Corps.
Major (Acting Lieut.-Col.) P. Davidson, C.M.G., D.S.O., M.B., Royal Army Medical Corps.
Capt. K. K. Drury, M.C., M.D., Royal Army Medical Corps (Special Reserve).
Capt. T. I. Dunn, M.C., M.B., Royal Army Medical Corps (Special Reserve).
Temp. Capt. M. du B. Ferguson, M.D., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) R. S. H. Fuhr, C.M.G., D.S.O., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) J. S. Gallie, D.S.O., Royal Army Medical Corps.
Lieut.-Col. and Brevet Col. (Temp. Col.) T. W. Gibbard, M.B., K.H.S., Royal Army Medical Corps.
Temp. Capt. R. E. Gibson, M.B., Royal Army Medical Corps.
Lieut.-Col. T. A. Granger, M.B., Indian Medical Service.
Temp. Capt. S. S. Greaves, M.C., Royal Army Medical Corps.
Lieut. Col. (Temp. Col.) J. Grech, D.S.O., Royal Army Medical Corps.

Capt. A. H. Heslop, D.S.O., M.B., Royal Army Medical Corps.
Lieut.-Col. H. C. R. Hime, D.S.O., M.B., Royal Army Medical Corps.
Col. W. E. Hudleston, D.S.O.
Lieut.-Col. (Temp. Col.) L. Humphry, C.M.G., Royal Army Medical Corps.
Temp. Capt. H. G. Kilner, M.B., Royal Army Medical Corps.
Col. Sir W. B. Leishman, C.B., F.R.S., M.B., F.R.C.P., K.H.P.
Major (Temp. Col.) C. H. Lindsay, C.M.G., M.D., Royal Army Medical Corps.
Capt. J. G. McCutcheon, M.B., Royal Army Medical Corps (Special Reserve).
Col. S. Macdonald, C.B., C.M.G., M.B.
Lieut.-Col. and Brevet Col. A. J. Macnab, F.R.C.S., Indian Medical Service.
Lieut.-Col. J. F. Martin, C.M.G., M.B.
Col. F. J. Morgan, C.M.G.
Lieut.-Col. (Temp. Col.) E. M. Morphew, D.S.O., Royal Army Medical Corps.
Col. D. M. O'Callaghan, C.M.G.
Surg.-Gen. M. W. O'Keeffe, C.B., M.D.
Lieut.-Col. (Temp. Col.) G. J. A. Ormsby, M.D., D.S.O., Royal Army Medical Corps.
Major (Temp. Lieut.-Col.) E. T. Potts, D.S.O., M.D., Royal Army Medical Corps.
Temp. Capt. G. Rankine, M.C., M.B., Royal Army Medical Corps.
Col. (Temp. Surg.-Gen.) B. M. Skinner, C.B., C.M.G., M.V.O.
Capt. O. W. D. Steel, M.C., Royal Army Medical Corps.
Col. G. St. C. Thom, C.M.G., M.B.
Lieut.-Col. (Temp. Col.) A. G. Thompson, D.S.O., M.B., Royal Army Medical Corps.
Major-Gen. H. N. Thompson, C.B., C.M.G., D.S.O., M.B.
Capt. L. R. Tosswill, Royal Army Medical Corps.
Capt. L. R. Turner, Royal Army Medical Corps.
Major (Temp. Lieut.-Col.) D. P. Watson, M.B., Royal Army Medical Corps.
Temp. Capt. R. H. G. Weston, M.B., Royal Army Medical Corps.

Consultants.

Major (Temp. Lieut.-Col.) H. A. Ballance, M.D., F.R.C.S.
Temp. Major-Gen. Sir A. A. Bowlby, K.C.M.G., K.C.V.O., F.R.C.S.
Temp. Major-Gen. Sir J. R. Bradford, K.C.M.G., C.B., F.R.S., M.D
Major R. H. Cooper, Royal Army Medical Corps.
Temp. Major-Gen. Sir B. E. Dawson, G.C.V.O., C.B., M.D.
Major (Temp. Col.) H. McI. W. Gask, C.B., M.B., F.R.C.S.
Major (Temp. Col.) H. McI. W. Gray, C.B., M.B., F.R.C.S.
Col. E. M. Pilcher, D.S.O., M.B., F.R.C.S.
Temp. Col. O. W. Richards, D.S.O., M.D., F.R.C.S.
Temp. Col. T. Sinclair, C.B., F.R.C.S.
Lieut-Col. (Temp. Col.) C. B. Thorburn, C.B., M.D., F.R.C.S.
Temp. Major-Gen. C. S. Wallace, C.M.G.
Capt. (Temp. Col.) A. E. Webb-Johnson, D.S.O., M.B., F.R.C.S.
Temp. Col. Sir A. E. Wright, C.B., M.D., F.R.C.S.I., F.R.S.

ROYAL ARMY MEDICAL CORPS.

Temp. Capt. J. Alexander, M.B.
Temp. Capt. A. S. K. Anderson, D.S.O., M.C., M.B.
Temp. Capt. J. S. Arkle, M.B.
Qmr. and Hon. Major H. J. F. Audus.
Temp. Capt. C. C. Austen.
Temp. Capt. T. B. Batchelor.
Qmr. and Temp. Lieut. V. A. Bell.
Temp. Capt. W. C. Blackham, M.B.
Temp. Capt. A. D. Blakeley, M.B.
Capt. (Acting Lieut.-Col.) W. W. Boyce.
Temp. Capt. C. F. Brady, M.B.
Temp. Qmr. and Hon. Capt. B. G. Brook.
Temp. Capt. G. M. Brown, M.B.
Major (Acting Lieut.-Col.) C. G. Browne, D.S.O.
Qmr. and Hon. Major E. J. Buckley.
Temp. Hon. Lieut.-Col. H. Cabot.
Temp. Capt. J. P. Cahir, M.B.
Temp. Capt. S. B. B. Cambell, M.B.
Temp. Capt. T. H. Cambell, M.B.
Temp. Capt. H. M. B. Caplan.
Temp. Capt. F. F. Carr-Harris, D.S.O., M.D.
Temp. Capt. M. T. Cassidy, M.B.
Temp. Capt. A. W. S. Christie, M.B.
Temp. Lieut. J. S. Clark, M.B.
Capt. (Acting Lieut.-Col.) C. Clarke, M.B., F.R.C.S.
Temp. Capt. C. J. W. Clayton.
Major T. S. Coates, M.B.
Temp. Capt. C. G. Colyer.
Temp. Capt. J. A. Conway, M.C., M.D.
Major R. H. Cooper.
Temp. Capt. G. M. Cowper.
Temp. Capt. W. Crabtree, M.B.
Temp. Capt. J. Crawford, M.C.
Qmr. and Hon. Capt. F. C. Cross.
Temp. Capt. J. M. D. Cruickshank.
Capt. (Temp. Lieut.-Col.) F. W. M. Cunningham, M.D.
Major (Acting Lieut.-Col.) J. Dalrymple.
Temp. Lieut.-Col. C. G. Douglas, M.C., M.D.
Temp. Capt. (Acting Lieut.-Col.) R. E. Drake-Brockman.
Lieut. (Temp. Capt.) C. R. Dudgeon, M.C.
Temp. Lieut.-Col. (Lieut.-Col., Aust.A.M.C.), W. J. E. Eames, C.B., M.D.
Temp. Capt. G. D. Eccles.
Temp. Capt. J. A. Edmund.

Temp. Capt. H. Emerson, M.C., M.B.
Qmr. and Hon. Capt. C. A. Figg.
Temp. Capt. C. C. Forsyth.
Temp. Capt. D. S. Graham.
Temp. Capt. H. B. Graham, D.S.O., M.B.
Temp. Capt. A. Gray, M.D.
Major (Acting Lieut.-Col.) G. D. Gray, M.D.
Qmr. and Hon. Major J. Green.
Major (Temp. Lieut.-Col.) R. C. Hallowes, M.B.
Lieut.-Col. A. E. Hammerton, D.S.O.
Temp. Capt. C. Harris.
Lieut.-Col. (Temp. Col.) J. A. Hartigan, D.S.O.
Major (Temp. Lieut.-Col.) T. E. Harty, D.S.O.
Major (Temp. Lieut.-Col.) W. J. S. Harvey, D.S.O.
Capt. (Acting Lieut.-Col. R. Hemphill, M.B.
Temp. Capt. F. W. Hird, M.B.
Major J. E. Hoar.
Temp. Qmr. and Hon. Capt. T. W. Jent.
Temp. Capt. L. C. Johnson.
Temp. Capt. (Acting Lieut.-Col.) A. Jones, M.C., M.D.
Temp. Capt. W. D. Kennedy, M.B.
Temp. Qmr. and Hon. Lieut. E. Kerstein, M.C.
Temp. Hon. Major L. F. B. Knuthsen, R.A.M.C.
Temp. Capt. P. J. Lane, M.C., M.B.
Temp. Capt. R. M. Lang, M.B.
Qmr. and Hon. Lieut. H. B. Lee.
Temp. Capt. R. D. Lemon, M.B.
Temp. Qmr. and Hon. Lieut. P. le Poidevin.
Major (Acting Lieut.-Col.) R. P. Lewis.
Temp. Capt. G. A. Lilly.
Temp. Capt. S. J. L. Lindeman.
Temp. Capt. W. H. Lister, D.S.O., M.C.
Temp. Capt. A. L. Lockwood, M.C. M.D.
Major J. L. London, M.B.
Temp. Capt. P. A. MacCullum, M.B.
Temp, Capt. S. E. McClatchly, M.B.
Temp. Capt. J. W. Macfarlane, M.C., M.B.
Temp. Capt. R. McGrath, M.B.
Temp. Qmr. and Hon. Lieut. J. B. Mackay.
Temp. Capt. R. A. MacNeill, M.B.
Temp. Capt. A. C. B. McMurtrie, F.R.C.S., M.D.
Temp. Capt. W. R. P. McNeight, M.D.
Capt. (Acting Lieut.-Col.) A. N. R. McNeill, M.B.
Temp. Lieut.-Col. A. Martin-Leake, V.C., F.R.C.S.
Temp. Capt. A. F. Mavety, M.B.
Temp. Qmr. and Hon. Lieut. H. Miller.
Temp. Capt. D. M. Morison, M.B.
Temp. Capt. J. Morrison, M.B.
Temp. Capt. H. H. P. Morton.
Capt. W. P. Mulligan. M.B.
Capt. W. G. Mumford, M.B., F.R.C.S.
Major (Acting Lieut.-Col.) C. D. Myles, M.B.
Temp. Capt. G. E. Nicholls, M.B.
Capt. (Acting Lieut.-Col.) T. B. Nicholls, M.B.
Temp. Hon. Capt. H. Nockolds, M.B.
Capt. (Acting Lieut.-Col.) J. J. O'Keeffe, M.C., M.B.
Major (Temp. Lieut.-Col.) A. C. Osburn, D.S.O.
Qmr. and Hon. Capt. (Acting Major) J. T. Packard.
Capt. E. Phillips, M.C., M.B.
Temp. Capt. F. E. L. Phillips.
Temp. Capt. J. G. Pigott.
Lieut.-Col. J. Powell, M.B.
Temp. Capt. J. A. Pringle, M.D.
Temp. Capt. J. Proctor, M.B.
Temp. Capt. (Temp. Lieut.-Col.) C. D. Pye-Smith, D.S.O., M.C., F.R.C.S., M.B.
Temp. Capt. C. R. Reckitt.
Temp. Capt. G. W. Riddel, M.B.
Temp. Capt. A. C. Rowswell, M.B.
Capt. (Acting Lieut.-Col.) C. Scaife, M.D.
Temp. Capt. C. Scales, M.D.
Qmr. and Hon. Capt. E. B. Senior.
Temp. Capt. (Acting Lieut.-Col.) L. D. Shaw, D.S.O., M.B.
Major (Acting Lieut.-Col.) H. C. Sidgwick, M.B.
Major M. Sinclair, M.B.
Temp. Qmr. and Hon. Lieut. E. B. Snowden
Qmr. and Hon. Lieut. E. B. Steele.
Major (Acting Lieut.-Col.) W. L. Steele.
Temp. Lieut.-Col. G. N. Stephen.
Temp. Capt. D. S. Taylor.
Major (Acting Lieut.-Col.) C. H. Turner, D.S.O.
Temp. Capt. G. W. Twigg, M.D.
Major (Acting Lieut.-Col.) T. B. Unwin, M.B.
Capt. (Acting Lieut.-Col.) E. W. Wade, M.B.
Temp. Capt. W. Warburton, M.B.
Major (Acting Lieut.-Col.) W. J. Waters.
Capt. W. L. Webster, M.B.
Temp. Capt. W. W. Wells, M.B.
Temp. Capt. C. R. Whittaker, F.R.C.S.
Temp. Capt. D. R. Williams.
Temp. Capt. R. L. Williams, M.C.
Qmr. and Hon. Capt. F. Wilson.
No. 77055 Serjt. G. W. Ames.
No. 339026 Serjt. C. Atherton.
No. 19336 Cpl. (Acting Staff-Serjt.) A. Barnes.
No. 13338 S. M. Boxhall, H.S.
No. 42527 Pte. (Acting Cpl.) R. H. Bradbury.
No. 71956 Pte. (Acting Serjt.) J. W. Briggs.
No. 16756 Staff-Serjt. (Acting Qmr.-Serjt.) N. W. Brown.
No. 40423 Pte. (Acting Serjt.) F. J. Burgess.
No. 62700 Serjt. F. E. Buxton.
No. 18061 Staff-Serjt. (Acting Serjt.-Major) W. Cairns.
No. 48925 Pte. (Acting Cpl.) A. Channing.
No. 48097 Pte. A. E. Chave.
No. 61883 Cpl. (Acting Serjt.) E. G. Clegg.
No. 38125 Cpl. (Acting Serjt.) A. C. Darbyshire.
No. 65323 Pte. (Acting Serjt.) D. T. Davidson.
No. 27943 Pte. A. Dickinson.
No. 53674 Cpl. (Acting Qmr.-Serjt.) H. Duke.
No. 90487 Pte. (Acting Cpl.) S. A. Dyer.
No. 77071 Pte. (Acting Serjt.) H. Evans.
No. 19688 Staff-Serjt. (Acting Serjt.-Major) T. V. Falkingham.
No. 15312 Serjt. G. Gillespie.
No. 54843 Cpl. R. B. Graham.
No. 71738 Pte. T. Hacking.
No. 89674 Pte. J. Hadfield.
No. 17212 Pte. (Acting Cpl.) F. Haskell.
No. 90454 Staff-Serjt. A. Hay.
No. 63912 Serjt. (Acting Staff-Serjt.) D. Jeffreys.
No. 48311 Serjt. G. J. Jones.
No. 54078 Serjt. (Acting Qmr.-Serjt.) W. Keighley.
No. 54640 Serjt. (Acting Qmr.-Serjt.) H. Kirwan.
No. 1659 Pte. (Acting Cpl.) J. Loram.

No. 17632 Qmr.-Serjt. H. C. A. Lunn.
No. 45969 Serjt. G. Mackay.
No. 32950 Pte. T. McWhannel.
No. 54443 Serjt. H. Mellor.
No. 320119 Cpl. A. Mennie.
No. 16397 Staff-Serjt. W. G. Mills.
No. 46711 Pte. J. Monaghan.
No. 640 Pte. A. Nixon.
No. 1278 Pte. I. Parker.
No. 75280 Serjt. S. R. Paskin.
No. 19126 Serjt. (Acting Serjt.-Major) F. H. Perkins.
No. 10031 Pte. W. Penman.
No. 32964 Serjt. (Acting Staff-Serjt.) F. E. Preston.
No. 41193 Pte. J. Rainey.
No. 59112 Pte. (Acting Cpl.) L. Richards.
No. 69111 Pte. (Acting Cpl.) M. H. Rowe.
No. 37022 Cpl. J. Simpson.
No. 76432 Cpl. (Acting Lance-Serjt.) W. C. Smith.
No. 8861 Serjt. E. Steffens.
No. 5731 Pte. (Acting Cpl.) T. Thorne.
No. 2276 Pte. (Acting Cpl.) D. Torrance.
No. 35182 Pte. H. Stansfield.
No. 15967 Serjt. W. T. Tringham.
No. 58655 Cpl. F. Turner.
No. 5134 Serjt. A. Vaughan.
No. 72533 Pte. (Acting Lance-Cpl.) F. A. Watson.
No. 90437 Pte. (Acting Lance-Cpl.) J. E. Williams.
No. 12185 Staff-Serjt. (Acting Qmr.-Serjt.) A. S. Willis.

Royal Army Medical Corps.

Capt. W. R. Blore, M.B.
Capt. C. F. Burton.
Capt. W. B. Cathcart, M.B.
Capt. E. M. Cowell, M.D., F.R.C.S.
Capt. T. G. Fleming, M.C., M.B.
Capt. F. H. Goss, M.B.
Capt. R. A. Greenwood, M.B.
Capt. (Acting Lieut.-Col.) C. J. A. Griffin.
Capt. T. F. Hegerty, M.B.
Capt. F. Jefferson, M.B.
Capt. J. I. Lawson, M.B.
Capt. W. McK. H. McCullagh, D.S.O., M.C., M.B.
Capt. (Acting Lieut.-Col.) S. Miller, M.C., M B.
Capt. G. H. C. Mold, M.B.
Capt. (Acting Lieut.-Col.) K. D. Murchison, D.S.O., M.B.
Capt. C. M. Page, M.B., F.R.C.S.
Capt. (Acting Lieut.-Col.) A. T. Pitts.
Capt. (Acting Lieut.-Col.) E. T. C. Robertson, D.S.O., M.B.
Capt. H. G. Trayer, M.B.

Royal Army Medical Corps (T.F.).

Capt. J. W. Anderson, M.C., M.B.
Capt. C. F. Backhouse.
Major T. A. Barron.
Major (Temp. Lieut.-Col.) E. B. Bird, D.S.O.
Capt. (Acting Lieut.-Col.) W. Blackwood, M.B.
Temp. Capt. L. Blake, M.B.
Qmr. and Hon. Capt. C. W. Braithwaite
Capt. (Temp. Lieut.-Col.) J. Bruce, M.B.
Capt. F. G. Caley, M.B.
Major (Acting Lieut.-Col.) A. Callam, M.B.
Capt. O. Cattlin.
Capt. J. W. Dale, M.B.
Capt. (Acting Lieut.-Col.) F. G. Dobson, M.B.
Capt. (Temp. Lieut.-Col.) C. W. Eames, M.D.
Lieut.-Col. W. E. Foggie, M.D.
Capt. and Brevet-Major (Temp. Lieut.-Col.) C. H. S. Frankau, M.B., F.R.C.S.
Capt. H. N. Goode, M.B., F.R.C.S.
Capt. J. M. Hamill.
Capt. T. R. Kenworthy, M.C.
Capt. G. C. King.
Capt. G. H. Kirby.
Capt. (Temp. Major) E. Knight, M.B.
Capt. (Acting Lieut.-Col.) C. L. Lander, M.C., M.B.
Capt. (Acting Lieut.-Col.) H. B. Low, M.C., M.D.
Capt. (Acting Lieut.-Col.) Mackie.
Capt. (Acting Lieut.-Col.) J. MacMillan, M.C., M.B.
Capt. S. A. S. Malkin.
Capt. A. C. Mallace, M.B.
Major (Temp. Lieut.-Col.) J. Nightingale, M.D.
Capt. R. P. Pollard, M.B.
Qmr. and Hon. Lieut. T. Priest.
Capt. H. H. Robinson, M.C.
Capt. F. E. W. Rogers.
Capt. S. Scott, M.B.
Capt. J. M. Smith, M.B.
Major (Temp. Lieut.-Col.) C. A. A. Stidston D.S.O., M.D.
Capt. W. Stobie, M.B.
Major (Temp. Lieut.-Col.) W. G. Sutcliffe, F.R.C.S.
Capt. A. C. Watkin.
Capt. (Acting Lieut..Col.) A. J. Williamson, M.D.
Major (Temp. Lieut.-Col.) P. G. Williamson, M.C., M.B.
No. 435439 Pte. F. Bayman.
No. 527013 Staff-Serjt. H. Body.
No. 405272 (Acting Cpl.) W. Briggs.
No. 536010 Serjt. F. Burridge.
No. 493723 Cpl. W. Chick.
No. 412002 Staff-Serjt. L. H. Clarke.
No. 305012 Serjt. J. R. Crabbe.
No. 337283 Serjt.-Major F. Fowles.
No. 403176 Pte. H. B. Garlick.
No. 461344 Cpl. C. R. Garrett, M.M.
No. 495191 Staff-Serjt. P. W. Glover.
No. 527784 Acting Serjt. F. A. Green
No. 461281 Serjt. (Acting Staff-Sergt.) H. H. Hayward.
No. 546228 Pte. C. E. Laugham.
No. 403650 Pte. E. McWilliams.
No. 417083 Cpl. A. Moran.
No. 386014 Qmr.-Serjt. (Temp. Serjt.-Major) P. T. Pickard.
No. 497317 Serjt. (Acting Staff-Serjt.) E. R. Ridley.
No. 339033 Serjt. (Acting Staff-Serjt.) A. Sandham.
No. 350236 Serjt. D. Shirt.
No. 512323 Serjt. W. C. S. Smither.
No. 426123 Pte. H. Walkerdine.
No. 527209 Pte. (Acting Cpl.) V. C. Wheeler.

War Office,
May 30, 1918.

The following dispatch has been received by the Secretary of State for War from General Sir Herbert Plumer, G.C.B., G.C.M.G., G.C.V.O., A.D.C. :—

Headquarters,
April 18, 1918.

My Lord,—I have the honour to submit a list of names of these officers, non-commissioned officers, and men, serving, or who have served, under my Command, whose distinguished and gallant services and devotion to duty I consider deserving of special mention,

I have the honour to be, My Lord,
Your obedient Servant,
Herbert Plumer, *General.*

Army Medical Service.

Staff.

Col. R. J. Blackham, C.M.G., C.I.E., D.S.O., M.D.
Col. S. L. Cummins, C.M.G., M.D., Royal Army Medical Corps.
Col. J. V. Forrest, C.M.G., Royal Army Medical Corps.
Lieut.-Col. C. H. Furnivall, Royal Army Medical Corps.
Capt. T. D. Inch, M.C., M.B., Royal Army Medical Corps.
Col. L. N. Lloyd, C.M.G., D.S.O., Royal Army Medical Corps.
Major-Gen. F. R. Newland, C.B., C.M.G., M.B.
Temp. Capt. W. J. Pearson, M.C., M.B., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) R. Pickard, C.M.G., M.B., Royal Army Medical Corps.
Col. T. du B. Whaite, C.M.G., M.B.

Royal Army Medical Corps.

Temp. Qmr. and Hon. Lieut. E. G. I. Brice.
Temp. Capt. W. E. Bullock, M.D.
Temp. Capt. P. J. Chissell.
Lieut.-Col. W. C. Croly.
Temp. Capt. S. J. Drake, M.C., M.B.
Temp. Capt. J. S. Davies.
Capt. D. G. Duff, M.B. (Special Reserve).
Temp. Capt. J. S. Doyle.
Temp. Capt. W. Duffy, M.B.
Temp. Qmr. and Hon. Lieut. C. Elliot, M.C.
Temp. Capt. D. G. Gardiner, M.B.
Temp. Qmr. and Hon. Lieut. T. H. Griggs.
Capt. (Acting Lieut.-Col.) A. Irvine-Fortescue, M.B.
Temp. Lieut. T. B. Johnston, M.B.
Lieut. (Temp. Capt.) T. J. Kelly, M.C.
Temp. Capt. T. L. Llewellyn, M.D.
Capt. H. W. Maltby (Special Reserve).
Capt. T. S. Nelson (Special Reserve).
Capt. (Temp. Lieut.-Col.) T. H. Scott, M.C., M.B.
Temp. Capt. T. Stordy.
Temp. Capt. T. Thompson.
Temp. Capt. H. Upcott.
Temp. Capt. R. R. Watts, M.B.
Lieut.-Col. J. W. West, M.B.
No. 295 Staff-Serjt. A. E. Cheer.
No. 4724 Pte. H. F. Davey.
No. 28385 Serjt. W. Greenwood.
No. 100910 Pte. (Acting Lance-Cpl.) J. Harte.
No. 83038 Pte. (Acting Cpl.) J. W. Hindley.
No. 10634 Serjt. (Acting Qmr.-Serjt.) F. Horn.
No. 10893 Pte. H. M. Howell.
No. 90257 Pte. J. G. Hunter.
No. 14464 Serjt.-Major G. F. Hurran.
No. 34131 Serjt. (Acting Staff-Serjt.) A. O. Judd.
No. 12694 Cpl. F. McCaffery.
No. 41766 Serjt.-Major J. E. Matthews.
No. 74102 Pte. (Acting Lance-Cpl.) W. J. Moody.
No. 66744 Serjt. H. J. Parker.
No. 19161 Staff-Serjt. G. Parkinson.
No. 74683 Serjt. (Acting Qmr.-Serjt.) H. W. Prince.
No. 59607 Pte. (Acting Lance-Cpl.) J. H. Robinson.
No. 30796 Staff-Serjt. L. J. Rowan.
No. 1827 Serjt T. F. Spratt.

Royal Army Medical Corps (Territorial Force).

Capt. L. Ball, M.B.
Capt. (Acting Major) W. Bowater, M.C.
Capt. (Acting Lieut.-Col.) T. A. Green, M.D., D.S.O.
Major (Acting Lieut.-Col.) G. H. L. Hammerton, D.S.O., M.C.
Capt. G. C. Soutter, M.D.
Qmr. and Hon. Capt. S. C. Wright.
Capt. B. M. Young.
No. 527010 Staff-Serjt. (Acting Serjt.-Major) S. P. Bristow.
No. 437192 Serjt. E. J. Bryden.
No. 435003 Staff-Serjt. A. Owen.

Central Chancery of the Orders of Knighthood.

St. James's Palace, S.W.,
June 3, 1918.

His Majesty the King has been graciously pleased, on the occasion of His Majesty's Birthday, to give orders for the following appointment, to the Most Honourable Order of the Bath, for valuable services rendered in connexion with Military Operations in Salonika. Dated June 3, 1918:—

To be Additional Member of the Military Division of the Third Class, or Companions, of the said Most Honourable Order :—

Col. Gerald Thomas Rawnsley, C.M.G., Army Medical Service.

War Office,
June 3, 1918.

His Majesty the King has been graciously pleased, on the occasion of His Majesty's Birthday, to approve of the undermentioned rewards for distinguished service in connexion with Military Operations in Salonika. Dated June 3, 1918 :—

TO BE BREVET COLONEL.

Lieut.-Col. F. J. Brakenridge, C.M.G., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) W. H. S. Nickerson, V.C., C.M.G., M.B., Royal Army Medical Corps.

TO BE BREVET LIEUTENANT-COLONEL.

(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories, as applicable.)

Major (Temp. Lieut.-Col.) C. W. Holden, D.S.O., Royal Army Medical Corps.

TO BE BREVET MAJOR.

(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories, as applicable.)

Capt. W. J. F. Mayne, M.B., Royal Army Medical Corps.

TO BE GRANTED THE NEXT HIGHER RATE OF PAY UNDER THE PROVISIONS OF THE ROYAL WARRANT.

Qmr. and Hon. Capt. P. A. Baynes, Royal Army Medical Corps.

AWARDED THE DISTINGUISHED SERVICE ORDER.

Royal Army Medical Corps.

Major (Acting Lieut.-Col.) Frederick Joseph Garland, M.B.
Capt. and Brevet-Major (Acting Lieut.-Col.) Benjamin Johnson, M.B.
Lieut.-Col. Montagu Marmion Lowsley.
Capt. (Temp. Lieut.-Col.) Hector Graham Gordon Mackenzie, M.B.
Lieut.-Col. John Robert Whait, M.B.
Major Ralph Koper White.
Temp. Major Harold Waterlow Wiltshire, M.D.

AWARDED THE MILITARY CROSS.

Royal Army Medical Corps.

Capt. William Dinsdale Anderton, M.B., Special Reserve.
Lieut. (Temp. Capt.) Desmond William Beamish.
Captain Eugene Henry Coyne, M.B.
Temp. Capt. Henry Harvard Davis.
Temp. Capt. Leslie Wilson Evans, M.B.
Temp. Capt. Claude Charles Harrison, M.B.
Capt. Wm. Ashley Lethem, M.B., Spec. Res.
Temp. Capt. John William Riddoch, M.B.
Capt. Frank Hubert Robbins.
Capt. Frank Scroggie, M.B.
Capt. Robert Glen Shaw, M.B.
Capt. Valentine Hutchinson Wardle.

His Majesty the King has been graciously pleased, on the occasion of His Majesty's Birthday, to approve of the undermentioned rewards for distinguished services in connexion with Military Operations with the British Forces in Salonika :—

AWARDED THE DISTINGUISHED CONDUCT MEDAL.

No. 18627 Staff-Sergt. H. Cockburn, Royal Army Medical Corps (Southampton).

His Majesty the King has been graciously pleased, on the occasion of His Majesty's Birthday, to approve of the award of the Meritorious Service Medal to the undermentioned Warrant Officers, Non-commissioned Officers and Men, in recognition of valuable services rendered with the Forces in Salonika :—

Royal Army Medical Corps.

No. 493137 Pte. G. E. Box (Chatham).
No. 32707 Pte. (Acting Staff-Serjt.) A. E. Brown (Anfield).
No. 497003 Temp. Serjt.-Major H. G. Freeman (Kingston).
No. 30179 Serjt.-Major L. Hayes (Kew).
No. 54590 Serjt.-Major C. W. Holt, D.C.M. (Dundalk).
No. 42722 Serjt.-Major S. Jacob (Moseley).
No. 25893 Pte. (Acting Serjt.) E. G. L'Estrange (Hastings).
No. 26639 Qmr.-Serjt. (Temp. Serjt.-Major) T. Liddell (Shirebrook).
No. 39376 Serjt.-Major A. J. Magee (Craghead).
No. 497075 Serjt. W. J. Maskrey (Kingston-on-Thames).
No. 512130 Pte. (Acting Qmr.-Serjt.) H. P. B. Owen (Mitcham).
No. 510257 Pte. (Acting Cpl.) F. R. Penichelli (Hammersmith).
No. 11627 Serjt.-Major H. Secker (Glasgow).
No. 510036 Qmr.-Serjt. J. G. Sinclair (Finsbury Park).
No. 527159 Lance-Cpl. (Acting Serjt.) W. G. Stanbrook (Southend, near Reading).
No. 388258 Cpl. W. Stephenson (Willington).
No. 53159 Serjt. (Acting Qmr.-Serjt.) H. S. Todd (Blaydon).
No. 53216 Serjt. H. C. White (Hastings).

June 3, 1918.

The King has been graciously pleased, on the occasion of His Majesty's Birthday, to signify His Majesty's intention of conferring the honour of Knighthood on the following:—

Mayo Robson, Esq., C.V.O., F.R.C.S.

For services rendered as Honorary Consulting Surgeon at the King Edward VII Memorial Hospital, Windsor. Past Vice-President of the Royal College of Surgeons.

June 3, 1918.

The King has been graciously pleased, on the occasion of His Majesty's Birthday, to give orders for the following promotions in, and appointments to, the Most Honourable Order of the Bath:—

To be Ordinary Member of the Military Division of the Third Class or Companion:—

Lieut.-Col. John Blackburn Smith, M.B., Indian Medical Service.

CHANCERY OF THE ROYAL VICTORIAN ORDER.

St. James's Palace,
June 3, 1918.

The King has been graciously pleased, on the occasion of His Majesty's Birthday, to make the following promotions in, and appointments to, the Royal Victorian Order:—

To be Knight Grand Cross:—

Lieut.-Gen. Sir Alfred Keogh, G.C.B., C.H.

To be Knight Commander:—

Lieut.-Col. Sir Edward Scott Worthington, C.M.G., M.V.O., Royal Army Medical Corps.

CENTRAL CHANCERY OF THE ORDERS OF KNIGHTHOOD.

St. James's Palace, S.W.,
June 3, 1918.

The King has been graciously pleased, on the occasion of His Majesty's Birthday, to give orders for the following appointments to the Most Honourable Order of the Bath for services in connexion with the War, dated June 3, 1918:—

To be Additional Members of the Military Division of the Third Class, or Companions of the said Most Honourable Order:—

Col. (Temp. Major-Gen.) George Bradshaw Stanistreet, C.M.G., M.B., Army Medical Service.

Canadian Force.

Col. Alexander Primrose, Canadian Army Medical Corps.

CHANCERY OF THE ORDER OF SAINT MICHAEL AND SAINT GEORGE.

Downing Street,
June 3, 1918.

The King has been graciously pleased, on the occasion of His Majesty's Birthday, to give directions for the following promotions in, and appointments to, the Most Distinguished Order of Saint Michael and Saint George for services rendered in connexion with the War, dated June 3, 1918.

To be Additional Members of the Second Class, or Knight Commanders of the said Most Distinguished Order:—

Temp. Major-Gen. Sir Berkley George Moynihan, C.B.

Col. William Heaton Horrocks, C.B., M.B. (retired pay), Army Medical Service.

Temp. Col. Sir Ronald Ross, K.C.B., F.R.S., F.R.C.S., Army Medical Service (retired pay), Indian Medical Service.

To be Additional Members of the Third Class, or Companions, of the said Most Distinguished Order:—

Temp. Col. Arthur Stanley Woodwark, M.D., Army Medical Service.

Lieut.-Col. Francis Stephen Irvine, D.S.O., M.B., Royal Army Medical Corps.

Capt. (Temp. Hon. Lieut.-Col.) Donald John Armour, Royal Army Medical Corps (Special Reserve).

Canadian Force.

Col. George Eli Armstrong, Canadian Army Medical Corps.

Hon. Lieut.-Col. George Washington Badgerow, Canadian Army Medical Corps.

New Zealand Force.

Lieut.-Col. Cyril Hocken Tewsley, New Zealand Medical Corps.

Newfoundland Contingent.

Major Cluny Macpherson, M.D., Royal Newfoundland Regiment.

War Office,
June 3, 1918.

The King has been graciously pleased, on the occasion of His Majesty's Birthday, to approve of the undermentioned rewards for valuable services rendered in connexion with the War, dated June 3, 1918.

TO BE BREVET COLONEL.

(On Retired List, Reserve of Officers, New Army, or Territorial Force, in the case of Officers belonging to these categories as applicable.)

Surg. Lieut.-Col. J. F. Bateson, M.B. (retired pay), late Coldstream Guards.
Surg. Lieut.-Col. E. N. Sheldrake (retired pay), late Grenadier Guards.
Lieut.-Col. A. L. A. Webb, C.M.G., Royal Army Medical Corps.
Lieut.-Col. Sir E. S. Worthington, C.M.G., M.V.O., Royal Army Medical Corps.

TO BE BREVET LIEUTENANT-COLONEL.

(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories, as applicable.)
Major F. G. Faichnie (retired pay), Reserve of Officers, Royal Army Medical Corps.
Capt. and Brevet Major H. M. Rigby, K.C.V.O., M.B., F.R.C.S., Royal Army Medical Corps.
Capt. and Brevet Major Sir H. J. Stiles, M.B., F.R.C.S., Royal Army Medical Corps (Temp. Lieut.-Col.), Royal Army Medical Corps.

TO BE BREVET MAJOR.

(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories as applicable.)
Capt. H. H. Blake, M.B., Royal Army Medical Corps.
Temp. Capt. A. E. Boycott, M.D., F.R.S., Royal Army Medical Corps.
Capt. (Acting Major) A. G. R. Foulerton, F.R.C.S., Royal Army Medical Corps.
Capt. C. C. Frye, Royal Army Medical Corps.
Capt. J. Gilmour, M.C., M.B., F.R.C.S.Edin., Royal Army Medical Corps.

TO BE HONORARY LIEUTENANT-COLONEL.

Qmr. and Hon. Major N. G. Copping (retired pay), Royal Army Medical Corps.
Qmr. and Hon. Major A. Wilson, Royal Army Medical Corps.

TO BE GRANTED THE NEXT HIGHER RATE OF PAY UNDER THE PROVISIONS OF THE ROYAL WARRANT.

Qmr. and Hon. Lieut. W. E. Squire, Royal Army Medical Corps.

June 3, 1918.

His Majesty the King has been graciously pleased, on the occasion of His Majesty's Birthday, to approve of the award of the Meritorious Service Medal to the undermentioned Non-commissioned Officer in recognition of valuable services rendered with the British Forces on the Mediterranean Line of Communications:—
No. 1905 Staff-Serjt. (Acting Serjt.-Major) J. O. Eves, Royal Army Medical Corps (Whitehall).

CENTRAL CHANCERY OF THE ORDERS OF KNIGHTHOOD.

St. James's Palace, S.W.
June 3, 1918.

The King has been graciously pleased, on the occasion of His Majesty's Birthday, to give orders for the following promotions in, and appointments to, the Most Excellent Order of the British Empire, for services in connexion with the War.
To be Commander of the said Most Excellent Order:—
Col. William Henry Parkes, C.M.G., Director of Medical Services, New Zealand Expeditionary Force.
To be Officers of the said Most Excellent Order:—
Lieut.-Col. Alexander Bruce, Army Medical Department, War Office.
Major Edward John Buckley, for service with the British Expeditionary Force in France.
Major Charles Ernest Goddard, M.D., President of a Recruiting Medical Board.
Lieut.-Col. William Ernest Grigor, Australian Army Medical Corps.
Major George Home, Officer in charge of Surgical Division, No. 2 New Zealand General Hospital.
Major Arthur Hammersley Johnson, M.R.C.S., L.R.C.P.
Major Alexander Lewis Urquhart, Royal Army Medical Corps, for services with the British Expeditionary Force, Salonika.
Capt. Thomas George Wakeling, President of a Recruiting Medical Board.
Major John Wilson, Officer Clerk, War Office Establishment.
Capt. Alfred Harwood, Statistical Branch, Department of Director-General, Army Medical Service.

St. James's Palace, S.W.
June 3, 1918.

The King has been graciously pleased, on the occasion of His Majesty's Birthday, to give orders for the following promotions in, and appointments to, the Most Honourable Order of the Bath, for valuable services rendered in connexion with Military Operations in France and Flanders, dated June 3, 1918.
To be Additional Members of the Military Division of the Third Class, or Companions of the said Most Honourable Order:—
Temp. Major-Gen. Sir Anthony Alfred Bowlby, K.C.M.G., K.C.V.O., F.R.C.S., Army Medical Service.

Temp. Major-Gen. Cuthbert Sidney Wallace, C.M.G., Army Medical Service.
Lieut.-Col. and Brevet-Col. (Temp. Col.) Thomas Wykes Gibbard, M.B., K.H.S., Army Medical Service.
Col. Stuart Macdonald, C.M.G., M.B., Army Medical Service.
Lieut.-Col. and Brevet-Col. Allan James Macnab, F.R.C.S., Indian Medical Service.
Col. Edgar Montague Pilcher, D.S.O., M.B., F.R.C.S., Army Medical Service.
Col. George St. Clair Thom, C.M.G., M.B., Army Medical Service.

CANADIAN FORCE.

Col. Arthur Edward Rose, C.M.G., Canadian Army Medical Corps.

CHANCERY OF THE ORDER OF SAINT MICHAEL AND SAINT GEORGE.

Downing Street,
June 3, 1918.

The King has been graciously pleased, on the occasion of His Majesty's Birthday, to give directions for the following promotions and appointments to the Most Distinguished Order of Saint Michael and Saint George, for services rendered in connexion with military operations in France and Flanders, dated June 3, 1918.

To be Additional Members of the Second Class, or Knights Commanders, of the said Most Distinguished Order:—

Surg.-Gen. Menus William O'Keefe, C.B., M.D.
Col. Sir William Boog Leishman, Kt., C.B., F.R.S., M.B., F.R.C.P., K.H.P.

To be Additional Members of the Third Class, or Companions, of the said Most Distinguished Order:—

Temp. Col. Owen William Richards, D.S.O., M.D., F.R.C.S., L.R.C.P., Royal Army Medical Corps.
Col. Wilfred Edward Hudleston, D.S.O., Army Medical Service.
Col. Robert William Clements, D.S.O., M.B.
Lieut.-Col. (Temp. Col.) Edward Maudsley Morphew, D.S.O., Royal Army Medical Corps.
Lieut.-Col. Thomas Arthur Granger, M.B., Indian Medical Service.
Lieut.-Col. (Temp. Col.) Harold Collinson, D.S.O., M.B., F.R.C.S., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) Albert George Thompson, D.S.O., M.B., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) James Stuart Gallie, D.S.O., Army Medical Service.
Lieut.-Col. William Richard Blackwell, Royal Army Medical Corps.
Major and Brevet Lieut.-Col. Eugene Ryan, D.S.O., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) James Andrew Hartigan, D.S.O., M.B., Royal Army Medical Corps.
Lieut.-Col. Albert Ernest Hamerton, D.S.O., Royal Army Medical Corps.
Major and Temp. Col. Henry McIlree Williamson Gray, C.B., M.B., F.R.C.S., Royal Army Medical Corps.
Major (Temp. Lieut.-Col.) William Lawrence Steele, Royal Army Medical Corps.
Temp. and Hon. Major Charles George Jarvis, L.R.C.P., Royal Army Medical Corps.
Major Maurice Sinclair, M.B., Royal Army Medical Corps.
Major (Temp. Lieut.-Col.) Edmund Thurlow Potts, D.S.O., M.D., Royal Army Medical Corps.

Canadian Force.

Col. John Munro Elder, Canadian Army Medical Corps.

Australian Force.

Col. Robert Beveridge Huxtable, D.S.O., V.D., Army Medical Corps.

War Office,
June 3, 1918.

His Majesty the King has been graciously pleased, on the occasion of His Majesty's Birthday, to approve of the undermentioned rewards for distinguished service in connexion with military operations in France and Flanders, dated June 3, 1918:—

TO BE BREVET-COLONEL.

(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories, as applicable.)

Lieut.-Col. (Temp. Col.) G. J. A. Ormsby, D.S.O., M.D., Royal Army Medical Corps.

TO BE BREVET LIEUTENANT-COLONEL.

(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories, as applicable.)

Major (Temp. Lieut.-Col.) E. B. Bird, D.S.O., Royal Army Medical Corps.
Major (Acting Lieut.-Col.) C. G. Browne, D.S.O., Royal Army Medical Corps.
Major (Acting Lieut.-Col.) P. Davidson, C.M.G., D.S.O., M.B., Royal Army Medical Corps.
Major (Acting Lieut.-Col.) C. H. Turner, D.S.O., Royal Army Medical Corps.

TO BE BREVET-MAJOR.

(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories, as applicable.)

Capt. L. G. Bourdillon, D.S.O., M.C., Royal Army Medical Corps.

To be Honorary Major.

Qmr. and Hon. Capt. J. W. Osborne, Royal Army Medical Corps.

To be granted the Next Higher Rate of Pay under the Provisions of the Royal Warrant.

Temp. Qmr. and Hon. Capt. C. A. Kay, Royal Army Medical Corps.

Awarded a Bar to the Distinguished Service Order.

Capt. (Temp. Lieut.-Col.) Arthur Thomas Pitts, D.S.O., Royal Army Medical Corps.

Awarded the Distinguished Service Order.

Royal Army Medical Corps.

Major Thomas Ashley Barron.
Capt. (Acting Lieut.-Col.) William Blackwood, M.B.
Capt. (Acting Lieut.-Col.) Colin Clarke, M.B., F.R.C.S.
Temp. Capt. James Alphonsus Conway, M.C., M.D.
Capt. Ernest Marshall Cowell, M.B., F.R.C.S.
Capt. (Temp. Lieut.-Col.) Francis William Murray Cunningham, M.D.
Temp. Capt. (Acting Lieut.-Col.) Ralph Evelyn Drake-Brockman.
Lieut.-Col. William Edward Foggie, M.D.
Capt. and Brevet-Major (Acting Lieut-Col.) Claude Howard Stanly Franknau, M.B., F.R.C.S.
Temp. Capt. Samuel Sowray Greaves, M.C.
Major (Temp. Lieut.-Col.) Richard Collis Hallowes, M.B.
Capt. (Acting Lieut.-Col.) Robert Hemphill.
Temp. Capt. (Acting Lieut.-Col.) Albert Jones, M.C.
Major (Acting Lieut.-Col.) Rowland Philip Lewis.
Major (Temp. Col.) Creighton Hutchinson Lindsay, C.M.G.
Capt. Ambrose Lorne Lockwood, M.C.
Capt. (Acting Lieut.-Col.) Arthur Norman Roy McNeill.
Capt. (Acting Lieut.-Col.) Sinclair Miller, M.C.
Temp. Hon. Capt. Humphrey Nockolds.
Lieut.-Col. John Powell, M.B.
Major Alan Charles Turner.
Capt. (Acting Lieut.-Col.) Ernest Wentworth Wade, M.B.
Major Douglas Percival Watson, M.B.
Capt. (Acting Lieut.-Col.) Alfred John Williamson.

Major (Temp. Lieut.-Col.) Ernest Charles Hodgson, Indian Medical Service.
Major Ernest Albert Churchward Matthews, Indian Medical Service.

Canadian Force.

Army Medical Corps.

Lieut.-Col. George Joseph Boyce.
Lieut.-Col. Anson Scott Donaldson.
Major George Herbert Rae Gibson.
Lieut.-Col. Archibald Lorne Campbell Gilday, M.C.
Lieut.-Col. John Nisbet Gunn.
Lieut.-Col. Joseph Hayes.
Lieut.-Col. Daniel Paul Kappele.
Major Theodore Adolf Lomer.

Australian Force.

Army Medical Corps.

Major Francis Lawrence Bignell.
Lieut.-Col. Edward Thomas Brenan, M.C.
Major Arthur Ross Clayton.
Capt. Mervyn John Holmes.
Lieut.-Col. William Elphinstone Kay.
Major Donald Stuart Mackenzie.
Lieut.-Col. (Temp. Col.) Frederick Arthur Maguire.
Lieut.-Col. Balcombe Quick.
Lieut.-Col. (Temp. Col.) Arthur Edmund Shepherd.
Major Walter Jaques Stack.
Major Wilfred Vickers.

New Zealand Force.

Major Erick Arthur Widdowson, M.C.

South African Contingent.

Major Charles Molteno Murray, M.C.

Awarded a Bar to the Military Cross.

*Capt. Thomas Stokoe Elliot, M.C., Royal Army Medical Corps.
Capt. Arthur Edmund Ironside, M.C., Royal Army Medical Corps (M.C. gazetted June 24, 1916).
*Temp. Capt. George William Blomfield James, M.C., Royal Army Medical Corps.
*Capt. Hamilton Stephen Moore, M.C., M.B., Royal Army Medical Corps.
Capt. (Acting Major) Hugh Huntley Robinson, M.C., Royal Army Medical Corps (M.C. gazetted November 14, 1916).
*Capt. John Rowe, M.C., M.B., Royal Army Medical Corps.

* *Note.*—In the cases marked by an asterisk the announcements of awards of the Military Cross have not yet been published in the *London Gazette*. These awards will be published in due course.

Awarded the Military Cross.

Royal Army Medical Corps.

Temp. Capt. Wilfred Herbert Alderton.
Temp. Capt. Robert Harper Alexander, M.B.
Capt. Robert Pringle Anderson, M.B.
Temp. Qmr. and Hon. Lieut. George Samuel Annett.
Temp. Capt. Geoffrey Thomas Baker.
Capt. Richard Pitt Ballard, M.B., Special Reserve.
Temp. Capt. Stanley Batchelor.
Temp. Capt. William David Bathgate.
No. 34731 Serjt.-Major Alfred Bolland.
Temp. Capt. William Brownlie, M.B.
Temp. Capt. Charles Walter Gordon Bryan.
Capt. Alexander Carruthers Bryson, M.B.
Capt. Frederick Charles Chandler, M.B.
Temp. Capt. Bloomfield George Henry Connolly, M.B.
No. 45555 Serjt.-Major Leslie Alfred Cronk.
Capt. David Dempster, M.B.
Capt. James Derham-Reid.
Temp. Capt. John Wescott Dew, M.B.
Capt. George Sampson Elliston.
Temp. Capt. Keith Douglas Falconer, M.B.
Temp. Capt. Richard Desmond Fitzgerald, M.B.
Qmr. and Hon. Capt. Charles Frederick Fraser.
Temp. Capt. Hope Murray Gillsie, M.B.
Capt. Charles Norman Grover, M.B., Special Reserve.
Temp. Capt. Ranald Montague Handfield-Jones.
Capt. Nicholas Hopkins Henry Haskins, M.B.
Capt. Sidney Martin Hattersley, M.B.
Temp. Capt. John Berry Haycraft, M.B.
Temp. Capt. Godfrey John Douglas Hindley, M.B.
Temp. Capt. Austin Harvey Huycke, M.D.
Capt. David William John, Special Reserve.
Temp. Capt. Joseph Greenfield Johnston, M.B.
Capt. Griffiths Lewis Jones, Special Reserve.
Temp. Capt. David Anderson Duncan Kennedy, M.B.
Lieut. (Acting Capt.) Gerald Patrick Kidd, Special Reserve.
Temp. Capt. Francis James Lidderdale, M.B.
No. 11370 Serjt.-Major Frederick Loveland.
Capt. Donald Christopher MacDonald, M.B., Special Reserve.
Temp. Capt. William James MacDonald, M.B.
Temp. Capt. John Beattie MacFarland.
Temp. Capt. Donald MacIntyre, M.B.
Capt. William George McKenzie.
Capt. William Farquhar McLean, M.B., Special Reserve.
Capt. Henry Proce Malcolm, M.B.
Capt. Francis Robery Henry Millan, Special Reserve.
No. 2653 Serjt.-Major Frederick Charles Morriscn.
Temp. Capt. Cusack O'Malley, M.B.
Temp. Capt. Herbert Massingberd Pentreath.
Capt. George Loraine Kerr Pringle, M.D.
Capt. Albert Ramsbottom, M.D.
Temp. Capt. Ralph Stuart Renton, M.D.
Capt. Douglas George Rice-Oxley.
No. 38683 Serjt-Major John Given Richardson.
Temp. Capt. Robert Stuart Ross.
Temp. Capt. William James Rutherford, M.D.
Qmr. and Hon. Lieut. George Sellex.
Capt. Clement Perronet Sells.
Capt. John James MacIntosh Shaw, M.B.
Capt. Edward Swan Simpson, M.B.
Capt. George Henderson Stevenson, M.B., Special Reserve.
Capt. Francis Geoffrey Thatcher, M.B.
Temp. Capt. John Hardwick Thornley, M.B.
Temp. Capt. James Arnaud Tobin, M.B.
Capt. William McNiell Walker, Special Reserve.
Temp. Capt. John Watson, M.B.
Temp. Capt. Alexander Urquhart Webster, M.B.

Canadian Force.

Capt. (Acting Major) William Theodore Ewing, Army Medical Corps.

Australian Imperial Force.

Army Medical Corps.

Capt. Roy Douglas Bartram.
Capt. Ivan Bede Jose.
Capt. Norman Reginald Mathews.
Capt. Cedric Murray Samson.
Capt. John Alexander Shanasy.

New Zealand Force.

Capt. Philip Blaxland Benham, New Zealand Medical Corps.

Awarded the Distinguished Conduct Medal.

Royal Army Medical Corps.

No. 536001 Qmr. Serjt. (Temp. Serjt.-Major) H. E. Bevans (St. John's, S.E.).
No. 354259 Pte. E. C. Bowkett (Manchester).
No. 303003 Staff-Serjt. (Acting Qmr. Serjt.) J. Brown (Aberdeen).
No. 55195 Serjt. D. Charleson (Leith).
No. 354100 Serjt. H. E. Dowling (Manchester).
No. 3910188 Serjt. A. Green (Hull).
No. 352080 Serjt. R. Lomax (Nelson).
No. 17091 Qmr. Serjt. (Acting Serjt.-Major) J. Moore (Edinburgh).
No. 1417 Pte. (Acting Lance-Cpl.), C. Smith (Winchester).

Chancery of the Order of Saint Michael and Saint George.

Downing Street,
June 3, 1918.

The King has been graciously pleased, on the occasion of His Majesty's Birthday, to give directions for the following appointment to the Most Distinguished Order of Saint Michael and Saint George, for services rendered in connexion with Military Operations in Italy. Dated June 3, 1918:—

To be Additional Member of the Third Class or Companion of the said Most Distinguished Order :—

Major (Acting Lieut.-Col.) George Herbert Leonard Hammerton, D.S.O., Royal Army Medical Corps.

AWARDED THE DISTINGUISHED SERVICE ORDER.

Lieut.-Col. William Chapman Croly, Royal Army Medical Corps.

Capt. (Temp. Major, Acting Lieut.-Col.) Thomas Arthur Green, M.D., Royal Army Medical Corps.

Temp. Capt. Wilfred John Pearson, M.C., M.B., Royal Army Medical Corps.

AWARDED THE MILITARY CROSS.

Royal Army Medical Corps.

Temp. Capt. Francis John Allen, M.B.
Temp. Capt. Lawrence Weir Bain, M.B.
Temp. Capt. William Edward Hallinan.
No. 17229 Serjt.-Major William Hutchens.
Temp. Capt. Eric Alfred Lumley, M.B.
Temp. Capt. Michael Patrick Power.
Capt. Ludwig Siebert Benjamin Tasker, M.B.
No. 12146 Serjt.-Major William John Wilson.

His Majesty the King has been graciously pleased, on the occasion of His Majesty's Birthday, to approve of the award of the Meritorious Service Medal to the undermentioned Warrant Officers, Non-commissioned Officers and Men in recognition of valuable services rendered with the Forces in Italy :—

ROYAL ARMY MEDICAL CORPS.

No. 18678 Qmr.-Serjt. (Temp. Serjt.-Major) L. S. Ellis (Brighton).
No. 35048 Serjt. (Acting Qmr.-Serjt.) H. H. Hards (London, N.W.).
No. 58965 Pte. (Acting Qmr.-Serjt.) D. A. Hart (London, E.).
No. 40178 Staff-Serjt. (Acting Serjt.-Major) W. Henser (Stoke).
No. 30629 Staff-Serjt. (Acting Serjt.-Major) G. Martin (Broadstairs).
No. 2007 Cpl. A. F. Morrell (Fulham).
No. 66577 Serjt. S. A. Peyton (Reading).
No. 36427 Pte. (Acting Serjt.) W. H. Pointon (Featherstone).
No. 33255 Serjt. W. A. Robertson (Glasgow).
No. 435017 Qmr.-Serjt. A. H. Stemp (Little Bromwich).
No. 90906 Staff-Serjt. (Acting Qmr.-Serjt.) F. W. G. Waghorne (Wembly).

CENTRAL CHANCERY OF THE ORDERS OF KNIGHTHOOD.

St. James's Palace, S.W.
June 3, 1918.

His Majesty the King has been graciously pleased, on the occasion of His Majesty's Birthday, to give Orders for the following appointments to the Most Honourable Order of the Bath, for valuable services rendered in connexion with Military Operations in Egypt, dated June 3, 1918.

To be Additional Members of the Military Division of the Third Class or Companions of the said Most Honourable Order :—

Col. Alfred Conquer Keeble, C.M.G., D.S.O.

Temp. Lieut.-Col. James William Barrett, C.M.G., Royal Army Medical Corps.

CHANCERY OF THE ORDER OF SAINT MICHAEL AND SAINT GEORGE.

Downing Street,
June 3, 1918.

His Majesty the King has been graciously pleased, on the occasion of His Majesty's Birthday, to give directions for the following appointment to the Most Distinguished Order of Saint Michael and Saint George, for services rendered in connexion with Military Operations in Egypt, dated June 3, 1918 :—

To be Additional Member of the Third Class or Companion of the said Most Distinguished Order :—

Col. Daniel O'Sullivan, F.R.C.S.I., Army Medical Service.

War Office,
June 3, 1918.

His Majesty the King has been graciously pleased on the occasion of His Majesty's Birthday, to approve of the undermentioned rewards for distinguished service in connexion with Military Operations in Egypt.

TO BE BREVET LIEUTENANT-COLONEL.

(On Retired List, Reserve of Officers, Special Reserve, New Army, or Territorial Force, in the case of Officers belonging to these categories, as applicable).

Major H. V. Bagshawe, D.S.O., Royal Army Medical Corps.

Major C. A. Gill, Indian Medical Service.

TO BE GRANTED NEXT HIGHER RATE OF PAY.

Qmr. and Hon. Lieut. C. F. Houston, M.C., Royal Army Medical Corps.

AWARDED THE DISTINGUISHED SERVICE ORDER.

Capt. (Acting Lieut.-Col.) Herbert William Carson, M.B., Royal Army Medical Corps.
Capt. (Acting Lieut.-Col.) John Wilson Leitch, M.B., Royal Army Medical Corps.
Capt. (Acting Lieut.-Col.) Thomas Bramley Layton, M.D., Royal Army Medical Corps.
Capt. Oakar Teichmann, M.C., Royal Army Medical Corps.
Lieut.-Col. Hugh Wright Thomson, M.D., Royal Army Medical Corps.

AUSTRALIAN FORCE.

Lieut.-Col. Arthur Lacy Dawson, Army Medical Corps.

NEW ZEALAND FORCE.

Major Charles Hercus, Medical Corps.

AWARDED THE MILITARY CROSS.

Capt. Douglas Wales Berry, M.D., Royal Army Medical Corps.
Capt. Humphrey Francis Humphreys, M.B., Royal Army Medical Corps.
Capt. Cyril Eaton Petley, Royal Army Medical Corps.

His Majesty the King has been graciously pleased, on the occasion of His Majesty's Birthday, to approve of the undermentioned rewards for distinguished service in connexion with the British Forces in Egypt :—

AWARDED THE DISTINGUISHED CONDUCT MEDAL.

No. 546124 Cpl. (Acting Coy. Serjt.-Major) L. T. Leybourne, Royal Army Medical Corps (Cambridge).
No. 32251 Serjt.-Major G. F. Lyon, Royal Army Medical Corps (Norwich).
No. 12496 Staff-Serjt. (Acting Serjt.-Major) J. McKay, Royal Army Medical Corps (Aberdeen).

His Majesty the King has been graciously pleased, on the occasion of His Majesty's Birthday, to approve of the award of the Meritorious Service Medal to the undermentioned Warrant Officers, Non-commissioned Officers and Man in recognition of valuable services rendered with the Force in Egypt :—

No. 545778 Pte. (Acting Serjt.) H. J. Garrett, Royal Army Medical Corps (Bristol).
No. 56188 Serjt. D. Gibson, Royal Army Medical Corps (Stamford Hill).
No. 60270 Serjt. (Acting Staff-Serjt.) A. E. Waight, Royal Army Medical Corps (Croydon).
No. 17057 Qmr.-Serjt. (Acting Serjt.-Major) M. Ward, Royal Army Medical Corps (Belfast).

War Office,
June 11, 1918.

The following Dispatch has been received by the Secretary of State for War from Lieut.-Gen. G. F. Milne, K.C.B., D.S.O., Commander-in-Chief, British Salonika Force :—

General Headquarters, Salonika,
March 25, 1918.

MY LORD,—I have the honour to submit herewith a list of the names of the Officers, Warrant Officers, Non-commissioned Officers, Men and Nursing Staff, whose services I desire to bring to your Lordship's notice for gallant conduct and distinguished services rendered during the period from September 21, 1917, to February 28, 1918.

I have the honour to be, My Lord,
Your Lordship's most obedient servant,
G. F. MILNE, *Lieut.-Gen.*

STAFF.

Lieut.-Col. P. H. Henderson, D.S.O., M.B., Royal Army Medical Corps.
Col. (Temp. Major-Gen.) M. P. C. Holt, K.C.M.G., C.B., D.S.O.
Col. G. T. Rawnsley, C.M.G.

ROYAL ARMY MEDICAL CORPS.

Temp. Capt. D. I. Anderson, M.B.
Temp. Capt. G. V. Bakewell, M.B.
Temp. Capt. D. M. Borland, M.B.
Temp. Capt. R. C. Brown, M.B.
Temp. Capt. P. C. Davie, M.B.
Capt. E. Davies, M.B.
Temp. Lieut. E. Gardner, M.B.
Major (Acting Lieut.-Col.) F. J. Garland, M.B.
Temp. Capt. T. E. George, M.B.
Capt. and Brevet-Major (Acting Lieut.-Col.) B. Johnson, M.B.
Lieut.-Col. M. M. Lowsley.
Temp. Capt. L. G. McCune, M.B.
Capt. A. M. McCutcheon, M.B.
Temp. Capt. J. H. McNicol, M.C., M.B.
Temp. Capt. F. H. Morrell, Special List.
Capt. (Acting Major) A. L. Urquhart, M.B.
Temp. Lieut.-Col. C. M. Wenyon, C.M.G., M.B.
Temp. Capt. E. C. White, M.B.
Major R. K. White.
Temp. Capt. A. Wilkin.
Temp. Major H. W. Wiltshire.
No. 55375 Cpl. E. Aitken.
No. 17169 Cpl. (Acting Lance-Serjt.) W. Andrews.
No. 148 Serjt. (Acting Staff-Serjt.) J. Ashcroft.
No. 105942 Pte (Acting Serjt.) A. Ashton.
No. 56211 Cpl. (Acting Serjt.) F. Baldwin.

No. 24217 Pte. F. Barlow.
No. 80541 Staff-Serjt. G. T. Berry.
No. 53341 Pte. J. R. Brierly.
No. 69333 Pte. (Acting Cpl.) G. C. Channon.
No. 18627 Staff-Serjt. B. Cockburn.
No. 40957 Staff-Serjt. (Acting Qmr.-Serjt.) F. J. Copeland.
No. 58578 Staff-Serjt. (Acting Qmr.-Serjt.) A. Darby.
No. 1216 Pte. (Acting Cpl.) J. Dunne.
No. 50357 Cpl. (Acting Lance-Serjt.) L. Dunstall.
No. 24154 Pte. H. R. Edwards.
No. 66975 Pte (Acting Serjt.) A. Engleby.
No. 59675 Serjt. T. Fletcher.
No. 79349 Cpl. (Acting Serjt.) H. H. Frankham.
No. 54527 Pte (Acting Lance-Cpl.) T. Froud.
No. 51445 Pte. H. J. Haynes.
No. 21340 Pte. (Acting Lance-Serjt.) R. Henderson.
No. 7246 Pte. (Acting Cpl.) T. Hickey.
No. 25810 Staff-Serjt. B. Hill.
No. 61840 Pte. G. W. Howell.
No. 75167 Pte. J. Inman.
No. 110318 Pte. (Acting Cpl.) O. E. Lloyd-Jones.
No. 23530 Qmr.-Serjt. A. Keen.
No. 78644 Serjt. (Acting Serjt.-Major) E. W. King.
No. 56640 Pte. (Acting Lance-Cpl.) J. A. Kinley.
No. 57433 Pte. K. E. Lightfoot.
No. 6367 Pte. (Acting Lance-Cpl.) J. E. Luff.
No. 36306 Cpl. (Acting Lance-Serjt.) J. P. Mannion.
No. 11211 Qmr.-Serjt. (Temp. Serjt Major) L. T. Marsden.
No. 6251 Serjt. (Acting Serjt.-Major) P. J. Martin.
No. 60081 Serjt. (Acting Staff-Serjt.) A. R. Miles.
No. 92433 Pte. R. Morris.
No. 75027 Serjt. A. Newton.
No. 76983 Serjt. J. O'Brien.
No. 39261 Cpl. (Acting Serjt.) H. Palk.
No. 31047 Pte. (Acting Lance-Cpl.) H. Parsons.
No. 68310 Pte. (Acting Cpl.) R. Paterson.
No. 60049 Pte. (Acting Serjt.) J. D. Perritt.
No. 52025 Pte. (Acting Cpl.) A. Redhead.
No. 30337 Pte. M. Ritchie.
No. 47032 Pte. F. H. Roberts.
No. 40719 Serjt. M. V. Sargent.
No. 1578 Acting Serjt. E. Savage.
No. 61753 Pte. (Acting Cpl.) W. Saxe.
No. 18957 Staff-Serjt. (Acting Company-Qmr.-Serjt.) A. C. Smith.
No. 21033 Pte. L. Spivey.
No. 79455 Pte. (Acting Cpl.) W. Stewart.
No. 68971 Pte. (Acting Lance-Serjt.) J. W. Straw.
No. 81787 Pte. R. C. Williams.
No. 19453 Staff-Serjt. A. C. Wingate.
No. 65533 Pte. R. A. Wood.
No. 1616 Cpl. (Acting Serjt.) H. C. Yates.

ROYAL ARMY MEDICAL CORPS (SPECIAL RESERVE).

Capt. T. Y. Barkley, M.B.
Capt. M. C. Cooper.
Capt. G. G. Drummond.
Capt. J. A. Musgrave,
Capt. H. B. Sherlock, M.C.
Capt. H. M. Torrance, M.B.

ROYAL ARMY MEDICAL CORPS (TERRITORIAL FORCE).

Capt. (Temp. Major) A. W. Falconer, D.S.O., M.B.
Capt. C. E. C. Ferrey.
Qmr. and Hon. Capt. G. W. Harris.
Capt. D. A. Harwood.
Capt. (Temp. Lieut.-Col.) H. G. G. Mackenzie.
Capt. W. H. Manson.
Capt. B. E. Potter.
Capt. P. S. Price.
Major and Brevet Lieut.-Col. F. E. A. Webb.
Lieut.-Col. J. R. Whait, M.B.
Capt. G. White.
Capt. H. W. Weir.
No. 493180 Serjt. A. G. Brace.
No. 527604 Staff-Serjt. T. F. Button.
No. 366128 Cpl. (Acting Lance-Serjt.) W. G. Charles.
No. 536145 Serjt. J. D. Clark.
No. 388130 Pte. T. W. Craigill.
No. 403018 Serjt. H. Duncan.
No. 497208 Serjt. A. Ford.
No. 493277 Pte. (Acting Lance-Cpl.) H. C. G. Geary.
No. 527057 Staff-Serjt. C. A. Grabham.
No. 527312 Lance-Cpl. C. S. Hasemer.
No. 495035 Pte. D. H. Hughes.
No. 510109 Pte. (Acting Lance-Cpl.) E. M. Jones.
No. 495594 Pte. V. W. Joy.
No. 587167 Cpl. (Acting Serjt.) F. H. Leatherdale.
No. 497186 Cpl. G. J. Lilly.
No. 510051 Pte. L. C. Maeers.
No. 396329 Pte. C. Prescott.
No. 545627 Cpl. (Acting Lance-Serjt.) J. R. Rogers.
No. 545547 Staff-Serjt. W. H. Scott.
No. 388190 Pte. W. F. Thwaites.
No. 216018 Staff-Serjt. F. Underhill.
No. 528058 Pte. (Acting Serjt.) W. R. Wilkins.

MISCELLANEOUS LIST.

J. Ramsbottom, Esq., attached Royal Army Medical Corps.

War Office,
June 14, 1918.

The following dispatch has been received by the Secretary of State for War from General Sir E. H. H. Allenby, G.C.M.G., K.C.B., General Officer Commanding-in-Chief, Egyptian Expeditionary Force:—

General Headquarters,
Egyptian Expeditionary Force.
April 3, 1918.

My Lord,—I have the honour to forward herewith a list of Officers, Ladies, Non-commissioned Officers and Men, serving, or who have served, under my command, whose distinguished and gallant services and devotion to duty I consider deserving of special mention.

I have the honour to be, my Lord,
Your Lordship's most obedient servant,
E. H. H. ALLENBY, *General.*

STAFF.

Capt. F. W. C. Brown, M.B., Royal Army Medical Corps.
Col. G. T. K. Maurice, C.M.G., Army Medical Service.
Lieut.-Col. (Temp. Col.) E. P. Sewell, D.S.O., M.B., Royal Army Medical Corps.

ARMY MEDICAL SERVICE AND ROYAL ARMY MEDICAL CORPS.

Temp. Lieut.-Col. J. W. Barrett, C.M.G.
Capt. (Acting Lieut.-Col.) H. W. Carson, M.B.
Lieut. (Temp. Capt.) E. Catford.
Qmr. and Hon. Capt. T. E. Coggon.
Major (Acting Lieut.-Col.) W. F. Ellis.
Lieut.-Col. W. P. Gwynn.
Temp. Capt. L. Leslie.
Temp. Capt. The Hon. L. H. Lindley, M.B.
Temp. Capt. T. F. Lumb.
Temp. Capt. (Acting Lieut.-Col.) A. T. Mulhall, F.R.C.S.I.
Temp. Capt. P. W. Moore, M.B.
Col. D. O'Sullivan, F.R.C.S.I.
Capt. (Acting Lieut.-Col.) G. F. Budkin, D.S.O.
Capt. W. H. Sheffield, M.B.
Temp. Capt. E. B. Smith, M.D.
Temp. Lieut. H. G. Sparrow.
Capt. (Acting Major) W. W. Treves, M.B., F.R.C.S.
Temp. Capt. J. G. Willmore.
No. 57267 Pte. (Acting Serjt.) F. H. Andrews.
No. 473207 Cpl. G. S. Briggs.
No. 18490 Staff-Serjt. (Acting Qmr.-Serjt.) H. Cooper.
No. 69398 Pte. C. Daly.
No. 22038 Pte. (Acting Serjt.) W. Darlington.
No. 63378 Pte. (Acting Serjt.) G. Fairclough.
No. 36115 Serjt. (Acting Staff-Serjt.) G. H. Hornby.
No. 25569 Qmr.-Serjt. (Acting Serjt.-Major) C. J. Judd.
No. 6803 Pte. W. Lee.
No. 33569 Serjt. (Acting Qmr.-Serjt.) W. Meeds
No. 32945 Serjt. F. C. Mitchell.
No. 51671 Pte. (Acting Serjt.) H. J. Rowlands.
No. 26666 Staff-Serjt. T. M. Sayer.
No. 19110 Serjt. (Acting Staff-Serjt.) C. H. Smith.
No. 16047 Qmr.-Serjt. (Temp. Serjt.-Major) P. Springett.
No. 1509 Serjt. A. Warren.
No. 1825 Serjt. (Acting Qmr.-Serjt.) A. G. Williams.

ROYAL ARMY MEDICAL CORPS (T.F.).

Capt. C. H. Allen, M.B., F.R.C.S.
Capt. C. S. P. Black, M.C., M.B.
Capt. (Temp. Major) T. G. Buchanan, M.B.
Capt. C. H. Budd, M.C., M.B.
Capt. W. K. Churchouse.
Capt. H. N. McC. Coombs, M.B.
Capt. W. F. Corfield, M.D.
Capt. A. D. Downes, M.B.
Capt. (Temp. Major) H. J. Dunbar.
Lieut.-Col. T. H. Forrest, D.S.O., M.B.
Lieut.-Col. A. G. Hamilton.
Capt. W. T. Henderson, M.B.
Temp. Capt. C. W. Jenner.
Capt. (Acting Lieut.-Col.) T. B. Layton, M.D.
Major (Acting Lieut.-Col.) J. W. Leitch, M.B.
Capt. E. A. Mackenzie
Capt. G. R. Rickett, M.D.
Capt. A. P. B. Smith.
Capt. J. B. Stanley.
Capt. O. Teichmann, M.C.
Lieut.-Col. H. H. Thomson, M.D.
Capt. F. Ward, M.D.
Capt. G. H. H. Waylen.
Capt. G. A. Williamson, M.D.
Capt. K. B. Williamson.
Capt. (Temp. Lieut.-Col.) J. Young, M.B., F.R.C.S.
No. 315086 Cpl. (Acting Serjt.) D. M. Alexander.
No. 416051 Cpl. (Acting Serjt.) H. Andrews.
No. 67947 Staff-Serjt. H. E. Eden.
No. 475165 Lance-Cpl. W. Harris.
No. 545446 Lance-Cpl. (Acting Serjt.) F. Hartley.
No. 533018 Serjt. H. S. Hiles.
No. 544796 Serjt. (Acting Serjt.) C. J. Legg.
No. 318004 Qmr.-Serjt. (Acting Serjt.-Major) W. Millar.
No. 320138 Serjt. W. Murray.
No. 362078 Serjt. W. Pritchard.
No. 303016 Qmr.-Serjt. (Acting Serjt.-Major) C. C. Thom.
No. 316087 Staff-Serjt. W. Thompson.
No. 472003 Serjt. V. J. Tootell.
No. 311064 Lance-Serjt. (Acting Serjt.) A. M. D. Wright.

War Office,
June 22, 1918.

His Majesty the King has been graciously pleased to approve of the following Awards to the undermentioned Officers and Warrant Officers, in recognition of their gallantry and devotion to duty in the Field :—

Awarded the Distinguished Service Order.

Capt. (Acting Lieut.-Col.) Robert Bernard Price, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. Prior to the division going into action he took over the duties of Assistant Director of Medical Services at half an hour's notice. When on one occasion all casualty clearing stations in the neighbourhood of the division were withdrawn, his improvisation on the previous night of an emergency casualty clearing station further to the rear proved of such inestimable value, that a large number of casualties were able to be dealt with and all the wounded evacuated with the utmost dispatch. Owing to the recourse, forethought and exceptional powers of organization, the smooth and successful evacuation of all the wounded was carried out during the period of twelve days' heavy and continuous fighting in which the division was engaged.

Awarded a Bar to the Military Cross.

Capt. John Henry Pearson Fraser, M.C., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. During the evacuation of a town he was in charge of a train loaded with stores and equipment. While the train was standing in the station without an engine it was heavily bombed by enemy aeroplanes. With bombs falling all round he secured an engine which had just backed into the station and coupled it to the train. He then collected a few men and cleared the permanent way of masses of débris caused by the bombs, and eventually got the train safely away under continual bombing by enemy aeroplanes. By his courage, determination and resource in a most difficult situation he succeeded in saving the whole trainload of equipment. (M.C. gazetted February 4, 1918.)

Temp. Capt. Frederick Theophilus Hill, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. Several hundred casualties of all branches of the service were passed through his unit during the day, and were evacuated promptly, thanks to his zeal, energy and efficient organization. When the enemy were advancing his unit was the last to leave the neighbourhood, and finally withdrew, when ordered to do so, and when every case had been evacuated, to join the division. He displayed outstanding devotion to duty. (M.C. gazetted June 23, 1915.)

Capt. (Acting Major) Herbert Stewart Milne, M.C., M.D., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty, when in charge of an advanced dressing station. In spite of continuous shelling he dressed and superintended the evacuation of the wounded during three days' operations with great success. When a shell fell among a party of men, killing three and wounding fourteen of them, he succeeded in dressing the more severely wounded and getting them all removed to a place of safety before the next burst of fire fell in the same spot. By his courage and resource he undoubtedly saved a further loss of life. (M.C. gazetted June 3, 1918.)

Temp. Capt. Matthew Arnold Swan, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. When the majority of his stretcher bearers had become casualties and his advance post had received two direct hits from shells he stayed at his post, dressed the wounded and supervised their evacuation. On many other occasions he showed the greatest courage, coolness and initiative, and his conduct has at all times been exemplary. (M.C. gazetted June 3, 1916.)

Awarded the Military Cross.

Temp. Capt. Warren Fullerton Clark, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. Whilst the battery was being heavily shelled two men were badly wounded. He at once proceeded out into the open, attended to these men under the most intense shell fire, carried them into a trench, and remained with them until an ambulance arrived. He showed magnificent coolness and an utter disregard of danger.

Temp. Capt. John Norman Cruickshank, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He attended to the wounded under heavy fire during an enemy attack. His skilful organization of stretcher bearers and his coolness and determination in a most difficult situation resulted in the saving of many lives.

Capt. John Francis Hill, M.B., Royal Army Medical Corps (Special Reserve).

For conspicuous gallantry and devotion to duty. He worked throughout the day under incessant shell fire, attending to the wounded during an enemy attack. Owing to his coolness and skill in a most difficult situation, many lives were saved.

Temp. Capt. Andrew Ferguson Horn, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He led his bearers forward to the front line during a heavy enemy attack and brought back many severely wounded men through the enemy's barrage. Throughout the operations he displayed splendid coolness and courage under heavy fire.

Qmr. and Hon. Capt. Robert Daniel Matthews, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. On hearing that two Sisters were lying injured on the adjacent railway station, he took over dressings and attended to them and other wounded while a hostile bombing raid was in progress. He brought back all the wounded to the hospital, and later worked continuously in a burning ammunition train at great risk from exploding shells, attending to the wounded and arranging for their comfort. His gallantry and coolness were deserving of the highest praise.

No. 16216 Serjt.-Major John William Robinson, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. Throughout two days he worked unceasingly, organizing and directing parties of stretcher bearers, visiting the advanced aid posts and supervising the work of the advanced dressing station, which was continuously shelled. Later, his marked organizing ability was made use of in the establishment of a new divisional collecting station to meet the emergency created by the absence of any clearing station within a short distance, and, thanks to his skill, resource and untiring energy, several hundred wounded cases were very rapidly evacuated in comparative comfort. His courage, endurance and devotion to duty during a period of ten days' fighting have been an inspiration to all ranks.

The following is the correct description of an Officer upon whom a Reward has recently been conferred :—

Temp. Capt. Alfred James Ireland, M.C., M.B., Royal Army Medical Corps. (M.C. gazetted August 25, 1917.)

War Office,
June 17, 1918.

His Majesty the King has been graciously pleased to approve of the award of the Meritorious Service Medal to the undermentioned Warrant Officers, Non-commissioned Officers and Men, in recognition of valuable services rendered with the Forces in France during the present war:—

ROYAL ARMY MEDICAL CORPS.

No. 42694 Pte. (Acting Cpl.) G. H. Adams (Dartmouth).
No. 545186 Pte. (Acting Serjt.) J. P. Addison (Brandon Colliery).
No. 26361 Cpl. (Acting Serjt.) G. E. Adey (Ashby-de-la-Zouch).
No. 50222 Pte. (Acting Serjt.) F. Alden (Norwich).
No. 32268 Qmr.-Serjt. T. W. Allcard (Grimsby).
No. 32048 Serjt.-Major A. N. Appleby (Leeds).
No. 48754 Staff-Serjt. (Acting Qmr.-Serjt.) E. Barmby (Preston).
No. 417296 Acting Serjt. C. F. Beck (Derby).
No. 508260 Serjt. A. E. Bennett (London, S.E.).
No. 545494 Serjt. J. Birnie (Birkenhead).
No. 60088 Pte. (Acting Serjt.) J. J. Blackie (Duns).
No. 401249 Serjt. T. Blakebrough (Leeds).
No. 473180 Qmr.-Serjt. G. Blows (Cherry-hinton).
No. 30539 Staff-Serjt. F. G. Boxall (Chudleigh).
No. 527369 Serjt. J. Briden (Walthamstow).
No. 48322 Serjt. (Acting Qmr.-Serjt.) E. J. Brown (Coleford).
No. 17151 Serjt. (Acting Qmr.-Serjt.) J. T. Brown (E. London).
No. 42914 Pte. (Acting Serjt.) W. J. Bunting (Belfast).
No. 34922 Qmr.-Serjt. A. W. Burden (London, S.W.).
No. 538086 Qmr.-Serjt. (Temp. Serjt.-Major) F. L. Burrows (W. Newington).
No. 50328 Serjt. J. H. Campbell (Waterhouse, Co. Durham).
No. 40941 Pte. S. Campbell (Belfast).
No. 45731 Serjt.-Major W. Campbell (Dunfermline).
No. 32187 Staff-Serjt. (Acting Serjt.-Major) H. V. Cattley (Whitby).
No. 527301 Serjt. H. A. G. Chandler (Haslemere).
No. 46033 Staff-Serjt. C. H. Chaston (Leigh-on-Sea).
No. 49426 Qmr.-Serjt. T. W. Clark (Sunderland).
No. 58999 Serjt. (Staff-Qmr.-Serjt.) H. Clarke (Sutton Bridge, Lincs.).
No. 2221 Serjt. (Acting Staff-Serjt.) G. Coleman (Wynberg, S. Africa).
No. 26552 Pte. S. Collins (Rhondda).
No. 352187 Pte. R. Cooper (Burnley).
No. 403556 Cpl. (Acting Serjt.) A. Cox (Mytholmroyd).
No. 16092 Cpl. (Acting Serjt.) C. Crowe (Maryborough (Queen's County).
No. 50971 Staff-Serjt. J. Dale (Woodhouse, near Sheffield).
No. 437003 Staff-Serjt. (Acting Serjt.-Major) A. H. Dancer (Sutton Coldfield).
No. 405019 Pte. F. Dent (Sheffield).
No. 403082 Qmr.-Serjt. A. M. Dewhurst (Shipley).
No. 337443 Pte. T. H. Dinsdale, M.M. (Walton).
No. 1862 Serjt. (Acting Staff-Serjt.) G. A. Doyle (Omagh).
No. 1188 Pte. (Acting Cpl.) M. Doyle (Dublin).
No. 417228 Qmr. Serjt. A. R. Ellis (Luton).
No. 527244 Pte. (Acting Serjt.) W. A. Ellis (Stamford Hill).
No. 545075 Serjt. E. Ellison (Essington).
No. 17450 Staff-Serjt. (Acting Qmr. Serjt.) W. J. Elsey (Pembroke Dock).
No. 19039 Serjt. (Acting Qmr.-Serjt.) J. T. Emerson (Cosham).
No. 56602 Staff-Serjt. (Acting Qmr.-Serjt.) E. Evans (Sunderland).
No. 536333 Qmr.-Serjt. I. Fisher (Wood Green).
No. 1464 Serjt. (Acting Qmr.-Serjt.) J. Fitzgerald (Aldershot).
No. 61985 Cpl. (Acting Lance-Serjt.) R. J. Fitzgibbons (Kennington Cross, S.E.).
No. 49093 Serjt. J. Fooks (Watchet, Somerset).

No. 4945 Serjt. (Acting Staff-Serjt.) J. E. Forman ((E). Aldershot).
No. 40655 Serjt.-Major H. J. C. Frewin (Ruislip).
No. 18507 Staff-Serjt. (Acting Qmr.-Serjt.) W. A. Gerrie (Aldershot).
No. 495216 Serjt. R. J. Giles (Folkestone).
No. 14452 Serjt. (Acting Staff-Serjt.) F. Godfrey (Edinburgh).
No. 514001 Qmr.-Serjt. (Temp. Serjt.-Major) W. R. Gillett (Clapham, S.W.).
No. 341279 Cpl. (Acting Serjt.) A. D. Goulding (St. Helens).
No. 73745 Pte. (Acting Cpl.) A. W. Grattidge (Leicester).
No. 545673 Pte. (Acting Serjt.) D. Gray (Carlisle).
No. 36896 Cpl. (Acting Serjt.) G. B. Green (Eastbourne).
No. 5168 Serjt. (Acting Qmr.-Serjt.) H. Gregory (Manchester).
No. 493322 Serjt. G. Gurney (Gillingham).
No. 59489 Serjt.-Major C. G. Gwynn (Hastings).
No. 45612 Serjt. J. C. Hagger (New Barnet).
No. 37849 Pte. (Acting Serjt.) D. Hall (Oldham).
No. 20478 Staff-Serjt. J. W. Hastings, D.C.M. (Manchester).
No. 395019 Serjt. A. Hedley (Newcastle-on-Tyne).
No. 72241 Serjt.-Major F. G. Herbert (Leicester).
No. 72152 Serjt. (Acting Qmr.-Serjt.) F. H. Herbert (Bromley, Kent).
No. 17250 Serjt. (Acting Staff-Serjt.) A. Hobbs (Guildford).
No. 47316 Serjt. (Acting Staff-Serjt.) P. G. Holloway (Bath).
No. 512250 Qmr.-Serjt. E. A. Hopkins (Harringay).
No. 58454 Staff-Serjt. (Acting Serjt.-Major) F. M. Hudson (South Shields).
No. 341291 Serjt. W. A. Hunter (St. Helens).
No. 17576 Qmr.-Serjt. (Acting Serjt.-Major) J. R. Ireson (Southminster).
No. 30623 Serjt.-Major J. R. Ivins (Chelsea, S.W.).
No. 534004 Staff-Serjt. W. James (Erith, Kent).
No. 38805 Serjt. (Acting Staff-Serjt.) E. C. Jeeves (Blunham).
No. 66321 Serjt.-Major F. W. Jeffries (Ringwood).
No. 19471 Cpl. (Acting Serjt.) D. C. Johnston (Bridge of Dunn).
No. 39536 Qmr.-Serjt. W. H. Jones (Barry Dock, Glam.).
No. 30624 Qmr.-Serjt. J. Judd, (Brixton, S.W.).
No. 339004 Lance-Serjt. J. Kay (Liverpool).
No. 4924 Pte. (Acting Cpl.) A. B. Kelly (Trimm, Co. Meath).
No. 13814 Qmr.-Serjt. (Acting Serjt.-Major) P. Kenneally (Castlemartyr).
No. 13032 Qmr.-Serjt. T. Kerr (Ballymena).
No. 19268 Cpl. (Acting Staff-Serjt.) J. B. Kersey (St. Leonards-on-Sea).
No. 345009 Serjt. (Acting Serjt.-Major) N. F. Kirkwood (Liverpool).
No. 73691 Pte. (Acting Cpl.) R. W. Kirtley (South Shields).
No. 55230 Cpl. (Acting Serjt.) W. J. Lawrence (Balham, S.W.).
No. 16442 Staff-Serjt. (Acting Qmr.-Serjt.) W. Lawson (Dublin).
No. 339483 Serjt. J. S. Leigh (Blackpool).
No. 2257 Serjt. T. J. Lever (Wolverhampton).
No. 527613 Staff-Serjt. (Acting Serjt.-Major) J. S. Lindley (Batley, Yorks).
No. 457372 Pte. (Acting Lance-Cpl.) R. Luxton (Exeter).
No. 16678 Qmr.-Serjt. (Acting Serjt.-Major) J. E. March (Leicester).
No. 60984 Serjt. J. G. Mark (Castle Eden, Durham).
No. 350168 Pte. J. B. Marsden (Glossop).
No. 18632 Pte. (Acting Serjt.) F. Martin (Gravesend).
No. 49848 Pte. (Acting Lance-Cpl.) G. Martin (Dublin).
No. 457240 Staff-Serjt. (Acting Qmr.-Serjt.) S. Martin (Torpoint).
No. 5808 Cpl. (Acting Staff-Serjt.) M. M. D. Maxwell (Worcester).
No. 14850 Staff-Serjt. (Acting Qmr.-Serjt.) T. G. Mayman (Southsea).
No. 49626 Pte. C. McConkey (Liverpool).
No. 12155 Serjt.-Major A. McKay (Aberdeen).
No. 35258 Qmr.-Serjt. D. McKechnie, M.M. (Dundee).
No. 59373 Serjt. W. Mellor (Manchester).
No. 12537 Qmr.-Serjt. (Temp. Serjt.-Major) F. Molloy (Cork).
No. 41200 Staff-Serjt. G. Morrell (Leeds).
No. 459420 Pte. E. W. Mumford (Lelant).
No. 19605 Cpl. (Acting Qmr.-Serjt.) M. Nairn (Colchester).
No. 403337 Serjt. W. Naylor (Knaresborough).
No. 510211 Serjt. E. E. Nott (Catford, S.E. 6).
No. 417221 Serjt. J. L. Oakes (Derby).
No. 15721 Serjt.-Major A. E. Odell (Loughborough).
No. 56588 Pte. W. O'Hare (Clough, Co. Down).
No. 386009 Qmr.-Serjt. (Acting Staff-Serjt.) H. Ord (Gosforth, Newcastle-on-Tyne).
No. 18213 Staff-Serjt. W. C. Pacey (Bordon).
No. 463003 Qmr.-Serjt. L. Parkhouse (Exeter).
No. 18718 Qmr.-Serjt. (Temp. Serjt.-Major) W. H. Parr (Lee, Kent).
No. 341430 Qmr.-Serjt. (Temp. Serjt.-Major) R. R. Parry (Liverpool).
No. 459002 Qmr.-Serjt. (Temp. Serjt.-Major) T. W. Parsons (Chudleigh, S. Devon).
No. 2225 Cpl. M. Paterson (York).
No. 32424 Pte. (Acting Cpl.) R. V. Peake (Southsea).
No. 65795 Serjt. A. C. Piper (Hailsham).
No. 17421 Serjt. P. Plume (Bury St. Edmunds).
No. 15096 Serjt.-Major J. E. Pugh (Shrewsbury).
No. 34410 Qmr.-Serjt. A. H. Purser (Cowes).
No. 61620 Staff-Serjt. H. Race (Bradford, Yorks).
No. 310022 Staff-Serjt. F. Rae (Aberdeen).
No. 37249 Serjt. J. Rattray (Perth).
No. 461029 Pte. (Acting Serjt.) A. Reed (Southampton).
No. 85911 Pte. (Acting Serjt.) J. F. Riggs (Pimlico, S.W.).
No. 33404 Cpl. S. T. Roberts (Liverpool).
No. 35954 Serjt.-Major D. C. S. Robertson (West Hartlepool).

No. 50101 Pte. (Acting Serjt.) A. W. Robinson (St. Ives).
No. 106920 Pte. R. Rooke (Boughton, near Faversham).
No. 39472 Staff-Serjt. (Acting Qmr.-Serjt.) A. V. Rowe (Middlewick).
No. 6125 Cpl. (Acting Serjt. A. J. Sage (E. Waterford).
No. 19933 Staff-Serjt. (Acting Qmr. Serjt.) W. C. Savegar (Aldershot).
No. 341411 Qmr.-Serjt. (Temp. Serjt.-Major) F. C. Scrutton (Penketh).
No. 47208 Serjt. J. A. Sharpley (Sunbury-on-Thames).
No. 527541 Staff-Serjt. G. W. Shipley (Marske-by-Sea).
No. 12411 Staff-Serjt. (Acting Qmr.-Serjt.) A. A. Sims (Reading).
No. 44847 Pte. (Acting Cpl.) H. Slee (Leeds).
No. 78018 Serjt. (Acting Qmr.-Serjt.) H. S. Smith (Mexborough).
No. 37373 Qmr.-Serjt. G. R. Spragg (Cheltenham).
No. 303053 Qmr.-Serjt. J. Stables (Kennethmont).
No. 38707 Serjt.-Major W. B. Stedman (Margate).
No. 17568 Serjt.-Major E. Steele (Surbiton).
No. 43087 Serjt. J. F. Stephen (Inverallochy).
No. 44817 Cpl. G. H. Stewart (Paisley).
No. 39086 Staff-Serjt. T. Stinton (Manchester).
No. 301010 Qmr. Serjt. C. F. Stuart (Torvie).
No. 11801 Cpl. (Acting Staff-Serjt.) J. Sturges (Oxford).
No. 49938 Qmr.-Serjt. N. Sumner (Warrington).
No. 4682 Serjt. A. E. Taylor ((E) Aldershot).
No. 42273 Serjt. W. Taylor (Bridlington).
No. 435317 Qmr.-Serjt. W. H. Taylor (Birmingham).
No. 545447 Pte. (Acting Lance-Serjt.) J. Topping (Carlisle).
No. 301241 Staff-Serjt. (Acting Qmr.-Serjt.) L. G. Tough (Aberdeen).
No. 35693 Serjt. (Acting Staff-Serjt.) W. J. Twidell (Luton).
No. 527140 Staff-Serjt. L. I. Ungar (Listria Park, N.).
No. 12790 Cpl. (Acting Serjt.) L. P. Unwin (Thornton Heath).
No. 34259 Staff-Serjt. W. Uden (Catford, S.E.).
No. 5880 Cpl. (Acting Qmr.-Serjt.) W. C. Vallance (Dublin).
No. 49962 Staff-Serjt. (Acting Qmr.-Serjt.) P. Walmsley (Brooke's Bar).
No. 18126 Serjt. (Acting Qmr.-Serjt.) T. P. Walshe (Rochester).
No. 18621 Staff-Serjt. (Acting Serjt.-Major) A. J. Walton (Birmingham).
No. 67281 Serjt. W. P. Waterhouse (Levenshulme).
No. 11320 Serjt.-Major R. Watts (Upper Tooting).
No. 493320 Qmr.-Serjt. (Temp. Serjt.-Major) W. W. Weedon (Maidstone).
No. 18821 Staff-Serjt. (Acting Serjt.-Major) G. Weston (Rochester).
No. 32197 Serjt.-Major J. S. Witham (Burnley).
No. 405420 Cpl. (Acting Serjt.) H. Wilde (Bradford).
No. 31747 Serjt.-Major G. M. Wilshaw (Burnley).
No. 401417 Staff-Serjt. A. E. Wood (Leeds).
No. 71796 Pte. E. F. Wood (Denholme).
No. 527854 Staff-Serjt. (Acting Serjt.-Major) F. H. Wood (Bromley).
No. 4356 Serjt. R. Woodman (Shepherd's Bush).
No. 5442 Serjt. (Acting Qmr.-Serjt.) A. E. Woodward (Stonehouse).
No. 15022 Staff-Serjt. (Acting Serjt.-Major) F. Woodward, D.C.M. (E. Swindon).
No. 64046 Serjt. D. Yates (Norton Malton).

June 26, 1918.

His Majesty the King has been pleased to award the Distinguished Conduct Medal to the undermentioned for Gallantry and Distinguished Service in the Field :—

No. 1828 Pte. M. Connolly, Royal Army Medical Corps (Dublin).

For conspicuous gallantry and devotion to duty. On an advanced aid post being subjected to a prolonged bombardment, during which period two direct hits from enemy shells were registered on it, he stayed at his post, and wherever casualties occurred he went out to bring in the wounded, rescuing six men in such a manner. Throughout this period he afforded magnificent proof of utter contempt for danger and outstanding devotion to duty.

No. 493540 Pte. R. B. McCoy, Royal Army Medical Corps (Maidstone).

For conspicuous gallantry and devotion to duty when the aerodrome of the squadron to which he was attached was attacked by enemy aircraft. He was badly wounded in the thigh by the first bomb that fell, and though he could only walk with great difficulty, he struggled towards the other casualties and attended to them while bombs were still dropping and the enemy aeroplanes were attacking the aerodrome with machine-gun fire. His splendid courage and self-sacrifice saved the life of a man who would have died had he not been attended to immediately.

June 27, 1918.

His Majesty the King has been graciously pleased to approve of the award of a Bar to the Military Medal to the undermentioned :—

No. 223 Serjt. (Acting Staff-Serjt.) W. Peake, M.M., Royal Army Medical Corps (Layerthorpe). (M.M. gazetted April 10, 1918.)

His Majesty the King has been graciously pleased to approve of the award of the Military Medal to the undermentioned Non-commissioned Officers and Men :—

ROYAL ARMY MEDICAL CORPS.

No. 106789 Pte. W. Ashton (Blackburn).
No. 426012 Serjt. G. W. Boaler (Leicester).
No. 19311 Pte. (Acting Cpl.) H. J. Cantello (Lavender Hill).
No. 32017 Pte. M. H. Cheetham (Sydenham).
No. 40527 Pte. (Acting Lance-Cpl.) J. Clarke (Middlewich).
No. 70568 Pte. W. Cox (Sheffield).
No. 315092 Pte. (Acting Lance-Cpl.) A. E. Dickson (Glasgow).
No. 493605 Pte. J. B. F. Duffett (Maidstone).
No. 495390 Pte. S. T. Edinborough (Folkestone).
No. 7227 Pte. (Acting Cpl.) J. Finn (Sheffield).
No. 61631 Pte. J. W. Gallagher (Dublin).
No. 44420 Pte. G. Glover (Hindley).
No. 6305 Cpl. (Acting Serjt.) A. W. Goswell (Folkestone).
No. 31557 Pte. W. H. Gotts (E. Bury St. Edmunds).
No. 31561 Pte. A. Green (Forest Hill).
No. 7491 Pte. C. T. Hartley (Bletchley).
No. 43543 Pte. P. L. Jarrett (Maidstone).
No. 493397 Pte. (Acting Cpl.) A. Larkin (Speldhurst).
No. 352589 Pte. W. Lawson (Manchester).
No. 73581 Pte. W. Leslie (Glasgow).
No. 31386 Pte. J. McPherson (Edinburgh).
No. 495335 Pte. H. A. W. Rainer (Folkestone).
No. 8881 Pte. J. Scholefield (Shipley).
No. 32668 Cpl. L. E. Smith (Sheffield).
No. 9024 Pte. E. Walton (Leeholme).
No. 59458 Pte. F. White (Tooting).
No. 12185 Staff-Serjt. (Acting Qmr.-Serjt.) A. S. Willis (Harringay).

ROYAL ARMY MEDICAL CORPS FUND.

PROCEEDINGS of a Committee meeting held at the Royal Army Medical College, Grosvenor Road, on Monday, June 10, 1918, at 2 p.m., the Director-General, Army Medical Service (Lieut-Gen. T. H. J. C. Goodwin, C.B., C.M.G., D.S.O., K.H.S.), presiding.

Present.

Major-Gen. G. B. Stanistreet, C.B., C.M.G., D.D.G., A.M.S.
Major-Gen. Sir W. Donovan, K.C.B.
Surg.-Gen. Sir D. Bruce, K.C.B.
Col. Sir J. Magill, K.C.B.
Lieut-Col. A. B. Cottell.
Major E. P. Offord.

(1) The minutes of the last meeting were read and confirmed.

(2) The question as to whether the education of children shall be undertaken by the General Relief Branch when the Compassionate School Fund is exhausted was considered, and it was decided to recommend to the Annual General Meeting that the principle should be approved, subject of course to the financial condition of the Fund at any time.

(3) The draft of proposed book of rules as recommended by the sub-committee was considered and adopted with certain minor amendments, and it was decided to recommend to the Annual General Meeting that it shall be adopted and printed at a cost not exceeding £10.

(4) The report of the memorials sub-committee was received, and after discussion it was decided to recommend to the Annual General Meeting—

(i) That a suitable memorial with portrait medallions of officers who were mainly concerned in the movement that led to the unification of the Army Medical Department and to the formation of the R.A.M.C. be erected in the Royal Army Medical College at a cost not exceeding £500.

(ii) That a special portrait of Lieut.-Gen. Sir A. Keogh, wearing the Insignia of the Grand Cross of the Bath, should be painted, and

(iii) That a portrait of Lieut.-Gen. Sir A. Sloggett, K.C.B., K.C.M.G., K.C.V.O., K.H.S., should be added to the gallery of Director-Generals in the mess room.

(5) Two applications for assistance from the General Relief Branch were considered and grants approved. In the case of one where there is a possibility of the pension being increased the amount not to exceed £1 a month up to a maximum of £6.

THE sixteenth Annual General Meeting of the Royal Army Medical Corps Fund was held in the library of the Royal Army Medical College on Monday, June 10, 1918, the Director-General (Lieut-Gen. T. H. J. C. Goodwin C.B., C.M.G., D.S.O., K.H.S.) presiding.

(1) The report of the Committee was read and adopted as follows:—

(i) The number of annual subscribers has diminished from 984 in 1916 to 824 in 1917; a considerable number of the young officers who were granted permanent commissions last year have joined in response to a circular letter which was sent out in August, and no doubt others will subscribe at the termination of the war. The Fund has sustained heavy losses by death.

(ii) The accounts of the Fund have been separated into two branches, viz., Officers' Branch for band dinner and memorials, and General Relief Branch, which includes the small amount still remaining which was originally allocated specially for the education of children.

STATEMENT OF ACCOUNTS OF THE OFFICERS BRANCH FOR THE YEAR 1917.

Receipts.	£	s.	d.
To Balance at Bank, December 31, 1916	397	17	10
,, Subscriptions	1,080	15	6
,, Dividends :—			
Caledonian Railway (Less Tax)	42	4	10
North British Railway (Less Tax)	43	14	2
,, War Loan 5 %	67	3	10
,, £600 Exchequer Bonds 5 %	11	11	0
,, Sold £23 13s. 6d. 5 % War Loan on Conversion	22	6	8
	£1,665	13	10

Expenditure.	£ s. d.	£	s.	d.
By Grants to Band		100	0	0
,, Fire Insurance for Q.A.M.H. Chapel		4	5	6
,, Royal School for Officers' Daughters		26	5	0
,, Easter Cards for Russian Medical Officers		6	15	0
,, Purchased £400 War Loan 5 %		380	0	0
,, ,, £400 ,, ...		381	6	0
,, ,, £50 ,, to make up total to £1,500		47	8	7
,, Three Subscriptions credited in error repaid ..		3	0	0
,, Office Expenses :—				
Shorthand Clerk	1 1 0			
Auditor	1 1 0			
Office Allowance	165 0 0			
Stationery, Postage and Printing ..	15 8 9			
Furniture, Telephone, &c. ..	3 10 0			
Cheque Book	0 4 2			
		186	4	11
,, Balance at Bank, December 31, 1917		530	8	10
		£1,665	13	10

Investments (at cost).

	£	s.	d.
Caledonian Railway 4 % Preference Stock	£1,408	0	0
North British Railway 4 % Preference Stock ..	1,457	0	0
War Loan 5% £2,300	2,186	7	11
	£5,051	7	11

,, Office Expenses £186 4 11

(Two-thirds of this will be refunded in 1918; One-third by R.A.M.C. Fund (General Relief Branch); One-third by R.A.M.C. Benevolent Society.)

We have compared the above statement with the books and vouchers relating thereto, and certify it to be correct. We have verified the Bank Balance and the Investments.

Portland House,
Basinghall Street, E.C.
April 30, 1918.

(*Signed*) EVANS, PEIRSON & CO.,
Chartered Accountants.

STATEMENT OF ACCOUNTS OF THE GENERAL RELIEF BRANCH FOR THE YEAR 1917.

RECEIPTS.	£	s.	d.
To Balance in hand, December 31, 1916	404	0	10
,, Grants from Companies and Units	1,475	8	2
,, Subscriptions and Donations	19	2	0
,, Dividends :—			
Canada Registered Stock	17	0	11
East India Railway Debenture Stock	27	16	4
War Loan	95	15	7
,, £1,000 Exchequer Bonds 6 %	52	0	4
,, £1,800 ,, ,, 5 %	46	4	0
	£2,137	8	2
,, Schools Account, as per Statement attached	144	0	5
	£2,281	8	7

EXPENDITURE.	£	s.	d.
By Grants to Companies	46	15	0
,, Union Jack Club	25	4	0
,, Soldiers and Sailors Help Society	5	0	0
,, Association for Employment of ex-Soldiers	5	0	0
,, R.A.M.C. Comforts	25	0	0
,, A. and N. Male Nurses Co-operation	20	0	0
,, Corps of Commissionaires	10	0	0
,, Transferred to Auxiliary R.A.M.C. Fund	411	14	6
,, Purchased £400 War Loan	380	0	0
,, ,, £700 National War Bonds	700	0	0
,, Bankers' Charges	2	0	0
,, Excess Dividends credited in error on War Loan—refunded	1	8	8
	£1,632	2	10
,, Schools Account, as per Statement attached	46	0	0
	£1,678	2	10
,, Balance Credit	603	5	9
	£2,281	8	7

INVESTMENTS (AT COST).	£	s.	d.
Canada $3\frac{1}{2}$ % 1930/50 Stock	606	1	3
East India Railway Co. $3\frac{1}{2}$ % Debenture Stock	1,060	0	0
£1,000 6 % Exchequer Bonds, 1920	1,000	0	0
£2,926 6s. War Loan 5 % Investment Stock	2,780	0	0
£700 National War Bonds	700	0	0
	£6,146	1	3

We have compared the above statement with the books and vouchers relating thereto, and certify it to be correct. We have verified the Bank Balance and the Investments.

Portland House,
Basinghall Street, E.C.
April 30, 1918.

(*Signed*) EVANS, PEIRSON & CO.
Chartered Accountants.

STATEMENT OF ACCOUNTS OF THE COMPASSIONATE SCHOOL FUND FOR THE YEAR 1917.

Receipts.		£ s. d.
To Balance in hand, December 31, 1916—		
Current Account	£141 10 5	
Deposit Account	100 0 0	
		241 10 5
,, Interest on Deposit Account		2 10 0
		£244 0 5

Expenditure.		£ s. d.
By Royal Soldiers' Daughters' Home		19 0 0
,, Drummond Institute		15 0 0
,, Catholic Home for Destitute Children		12 0 0
		£46 0 0
,, Balance in hand, December 31, 1917—		
Current Account	£98 0 5	
Deposit Account	100 0 0	
		198 0 5
		£244 0 5

We have compared the above statement with the books and vouchers relating thereto, and certify same correct. We have verified the Bank Deposit Account.

Portland House,
Basinghall Street, E.C.
April 30, 1918.

(*Signed*) EVANS, PEIRSON & CO.,
Chartered Accountants.

(iii) *Officers Branch.*—The income amounted to £1,267 16s., and as the expenditure continues to be small owing to the War, £850 has been invested in War Loan, 1915, 5 per cent., making a total now held by the branch in that security of £2,300.

(iv) *Dinner.*—There was no dinner last year and no expenditure on memorials.

(v) *Band.*—A grant of £100 has been made to the band.

(vi) *General Relief Branch.*—Grants and subscriptions to the amount of £1,494 10s. 2d. were received from companies and units abroad and as the applications for assistance were few in number a further sum of £1,100 has been invested in War Loan 5 per cent and National War Bonds. The annual subscriptions to the Union Jack Club and other societies are met by this branch.

(vii) *Compassionate School Fund.*—Grants have been made to the Royal Soldiers' Daughters' Home at Hampstead, the Drummond Institute in Ireland and the Catholic Home for Destitute Children, at each of which we have children being educated, and the sum of £198 remains. This will be sufficient to complete the education of the children now at school.

(viii) The Committee record with deep regret the death of Lieut.-Col. F. W. H. Davie Harris who had been secretary of the Society for more than eleven years and to whose unfailing efforts in the interests of the Fund much of its success is undoubtedly due.

(2) The accounts for the year 1917 which have been audited were considered and approved. A copy is attached to the *Proceedings.*

(3) The question of voting a grant from the Officers Branch to the General Relief Fund was discussed, and it was proposed by Col. C. R. Tyrrell, and seconded by Lieut.-Gen. A. T. Sloggett, that a sum of £25 be authorized. Carried.

(4) The principle as to whether the education of children shall be undertaken by the General Relief Branch when the sum of money still remaining in the Compassionate School Fund is exhausted was discussed. It was explained by the secretary that this Fund originated in a sum of nearly £1,400 subscribed by No. 6 General Hospital during the South African War and limited at the request of Col. Somerville Large, who was then in command, to the education of children. This amount is nearly exhausted and it is a question whether when it has been expended the education of children will subsequently be taken over by the General Relief Fund. After discussion it was proposed by Gen. Sir W. Donovan and seconded by Gen. Sir M. Russell, and carried, that the principle be approved that the education of children shall be taken over by the General Relief Fund when the sum belonging to the Compassionate School Fund is exhausted, subject to the financial position of the Fund at any future time.

(5) The proposed book of rules which has been circulated was approved with certain minor alterations to be adopted and printed, the cost not to exceed £10.

(6) *Memorials.*—The recommendation of the Committee as regards memorials to distinguished officers was considered and adopted as follows:—

(i) That a suitable memorial with portrait medallions of officers who were mainly concerned in the movement that led to the unification of the Army Medical Department and to the formation of the Royal Army Medical Corps be erected in the Royal Army Medical College at a cost not exceeding £500.

(ii) That a special portrait of Lieut.-Gen. Sir A. Keogh, wearing the Insignia of the Grand Cross of the Bath, should be painted, and

(iii) That a portrait of Lieut.-Gen. Sir A. Sloggett, K.C.B., K.C.M.G., K.C.V.O., K.H.S., should be added to the Gallery of Director-Generals in the mess room.

As regards the portraits, as there is at the present time great uncertainty as to the cost, the Committee are requested to furnish a further report before the matter is finally sanctioned.

(7) *Auditors.*—It was proposed by Sir D. Bruce and seconded by Sir W. Donovan that Messrs. Evans, Peirson and Co. be reappointed for the present year.

(8) A letter was read from Mr. V. G. M. Holt recommending that the £1,000 6 per cent. Exchequer Bonds, 1920, standing in the names of the trustees on account of the General Relief Branch should be sold and the proceeds invested in 5 per cent National War Bonds, 1928, and the difference resulting from the transaction added to the present holding of the Fund. It was "Resolved that Messrs. Holt and Co. be instructed to sell £1,000 6 per cent. Exchequer Bonds, 1920, held on account of the General Relief Fund, and to take up £1,200 5 per cent. National War Bonds, 1928, to be invested in the names of the trustees. Also that the Director-General be authorized to sign the Resolution on behalf of the Fund."

(9) The secretary reported that a sum of £28 13s. 6d. had been received as a Rebate of Income Tax for the General Relief Branch for the year 1917.

Secretary.—Proposed by Sir Launcelotte Gubbins and seconded by Sir A. Sloggett that Lieut.-Col. Wilson be elected secretary for one year. Carried.

E. M. Wilson,
Lieut.-Col., Secretary.

Minutes of a Committee Meeting held at Adastral House, War Office, on July 17, 1918.

Present:

Lieut.-Gen. T. H. J. C. Goodwin, C.B., C.M.G., D.S.O., K.H.S., Director General, in the Chair.
Major-Gen. G. B. Stanistreet, C.B., C.M.G., Deputy Director-General.
Major-Gen. Sir W. Donovan, K.C.B.
Col. C. R. Tyrrell, C.B.
Lieut.-Col. A. B. Cottell.
Major P. G. Easton, D.S.O.
Major E. P. Offord.

(1) The minutes of the previous meeting, held on June 10, were read and confirmed.

(2) The Secretary reported the printing of 600 copies of the new book of Rules which are being distributed to the subscribers.

(3) The Report of the Memorials Sub-Committee was considered and it was decided :—

(i) As regards the Memorials to certain distinguished officers who were mainly concerned in the unification of the Army Medical Department and the formation of the Royal Army Medical Corps that before making a final selection notification should be sent to:

(a) All Surgeon-Generals and Major-Generals, past and present, and

(b) All officers who were on the active list between 1870 and 1880, giving the names of officers provisionally proposed and asking for suggestions. The replies to be considered at the next meeting.

(ii) The offer of Mr. F. O. Salisbury to paint the portrait of Lieut.-Gen. Sir A. T. Sloggett was approved. The total inclusive charge not to exceed the amount agreed upon.

(iii) It was noted that the Memorials Sub-Committee are in communication with Sir A. Keogh.

(4) The Secretary submitted a Report of the meeting of the "Comrades of the Great War" Association on July 4, and it was decided that no action is necessary at present.

(5) A case of special distress under Rule 5 was considered and it was decided to sanction a monthly grant of £5 as a temporary measure pending the result of an appeal for an increase of pension which is now being dealt with by the financial authorities.

(6) The Secretary reported the sale of £1,000 6 per cent Exchequer Bonds and the purchase of £1,200 5 per cent National War Bonds which had been carried out on behalf of the General Relief Branch in accordance with the Resolution of the Annual General Meeting. He also reported the present cash balances in both branches of the Fund.

(7) An application for assistance from the widow of an ex-Staff-Serjeant under Rule 8 was considered and a grant of £6 authorized.

ROYAL ARMY MEDICAL CORPS OFFICERS' BENEVOLENT SOCIETY.

The Annual General Meeting was held at the Library, Royal Army Medical College, Grosvenor Road, S.W., at 3 p.m. on Monday, June 10, 1918, the Director-General, Army Medical Service (Lieut.-General T. H. J. C. Goodwin, C.B., C.M.G., D.S.O., K.H.S.), presiding.

(1) The Minutes of the last Annual General Meeting were read and confirmed.

(2) The report of the Committee for the year 1917 was considered and adopted as follows:—

The number of subscribers for the year was 181 and the amount of subscriptions £184 18s. 6d.

A sum of £196 7s. 6d. has been received as a rebate of Income Tax and is credited in the accounts for the year 1918.

Donations were received from :—

	£	s.	d.
Officers' Mess Training Centre, Ripon	20	0	0
Lieut.-Col. and Mrs. Brunskill	5	0	0
Royal Army Medical Corps Officers' Mess, Rawal Pindi	16	7	9
Surg.-Gen. and Mrs. Julian	30	0	0
An Anonymous Friend, per Major T. H. Gibbon..	14	0	0
A Legacy under the Will of the late Surg.-Gen. Sir Charles Cuffe ..	10	0	0

The total receipts amounted to £646 7s. 2d.

The £200 Exchequer Bonds purchased in 1916 have been converted into £200 5 per cent War Loan and an additional amount purchased bringing up the total holding of the Society in that Security to £450.

The total expenditure amounted to £735 3s. The office expenses for 1917 are being charged to the accounts of the year 1918, and will amount to £62 1s. 8d.

Thirty-one applicants representing fifty-eight orphans were granted £755.

The Committee record with deep regret the death of Lieut.-Col. Davie Harris, who had been secretary of the Society for more than eleven years, and to whose unfailing efforts in the interests of the Fund much of its success is undoubtedly due.

(3) The audited accounts for the year 1917 were received and approved. A copy is attached to these Proceedings.

(4) The grants to applicants recommended by the Committee for the year were considered and approved. Two other applications which had been received since the Committee meeting were considered and grants authorized. In a third case the application was refused. The amounts voted together with the initials of the applicants are attached.

(5) The Secretary reported that nearly 600 special notices had been sent out with a view to increasing the number of subscribers, and up to the present time forty-seven additional officers had joined the Society.

(6) The resignation of Col. J. L. Notter as Vice-President was accepted with regret, and it was proposed by Major-Gen. Sir W. Donovan and seconded by Col. Peterkin that Surg.-Gen. Sir Michael Russell be elected Vice-President. Carried. The other Vice-Presidents were re-elected.

(7) It was proposed by the Chair and seconded by Sir Launcelotte Gubbins that Surg.-Gen. Sir H. R. Whitehead be elected a member of the Committee. Carried. And that the remainder of the Committee be re-elected. Carried.

(8) *Auditors.*—The Auditors, Messrs. Evans, Peirson and Co., were re-elected Auditors.

(9) Lieut.-Col. E. M. Wilson was re-elected Secretary for one year from the present date.

(10) It was proposed by Sir A. Sloggett and seconded by Sir Launcelotte Gubbins that a very hearty vote of thanks be accorded to the Director-General for presiding at both meetings. Carried.

E. M. Wilson, *Lieut.-Colonel,*
Secretary.

Minutes of a Committee Meeting held at Adastral House, War Office, on July 17, 1918.

Present:

Lieut.-Gen. T. H. J. C. Goodwin, C.B., C.M.G., D.S.O., K.H.S., Director-General, in the Chair.
Major-Gen. Sir W. Donovan, K.C.B.
Surg.-Gen. Sir D. Bruce, K.C.B.
Surg.-Gen. Sir H. R. Whitehead, K.C.B.
Major-Gen. Sir M. W. Russell, K.C.M.G.
Col. A. Peterkin, C.B.
Lieut.-Col. A. B. Cottell.
Capt. J. T. Clapham.

(1) The minutes of the previous meeting, held on April 17, were read and confirmed.

(2) Sir M. W. Russell and Sir H. R. Whitehead took their places on the Committee as Vice-President and member respectively.

(3) The Secretary reported that 102 fresh subscribers had been obtained up to date as a result of the special appeal for additional members. He also reported the present cash balance at the bank.

(4) A special appeal was considered from Mrs. L. M. T. for a grant towards the outfit expenses of her daughter who has just been elected to the Royal School at Bath, and it was decided to sanction £20 under Rule 24.

(5) The desirability of making it more widely known that the Funds of the Society are only available for the benefit of "orphans" was discussed, and the Secretary was instructed to draw attention to the fact in all notices issued from his office.

LIST OF GRANTS AUTHORIZED TO APPLICANTS AT THE ANNUAL GENERAL MEETING, JUNE 10, 1918.

Three orphans of T. McC.	£40	Orphan of J. O.	£30
Three orphans of G. C.	40	Three orphans of W. T. H.	30
Orphan son of P. O. I.	10	Orphan son of R. G. H.	20
Orphan daughter of I. McC.	20	Two orphans of R. D. O'C.	20
Two orphan daughters of V. H. S.	20	Orphan of W. F. T. I.	40
Four orphan daughters of W. S. H.	40	Orphan of H. P. E.	10
Orphan daughter of T. S.	10	Orphan of T. B.	40
Orphan daughter of I. C.	25	Orphan of A. T.	30
Two orphans of F. M. M.	20	Two orphans of C. J. H.	20
Orphan of R. A. C.	40	Orphan of E. W. B.	30
Seven orphans of J. W.	30	Orphan of B. C. S.	20
Orphan son of C. A.	30	Seven orphans of W. H.	40
Orphan of J. F.	30	Orphan of H. H. S.	25
Orphan of A. S.	20		
			£730

STATEMENT OF ACCOUNTS OF THE ROYAL ARMY MEDICAL CORPS BENEVOLENT SOCIETY FOR THE YEAR 1917.

RECEIPTS.		£ s. d.
To Balance at Bankers', January 1, 1917		451 4 6
,, Subscriptions		184 18 6
,, Donations—		
Officers' Mess, R.A.M.C., Training Centre, Ripon	£20 0 0	
Col. and Mrs. Brunskill	5 0 0	
Officers' Mess, Rawal Pindi, per Capt. J. T. Clapham	16 17 9	
Surg.-Gen. O. R. A. and Mrs. Julian	30 0 0	
An Anonymous Friend, per Major T. H. Gibbon	14 0 0	
		85 17 9
,, Dividends—		
North Eastern Railway 3 % Debenture Stock (*less* tax £49 19s. 10d.)		149 19 8
London and North Western Railway 3 % Debenture Stock (*less* tax £50)		150 0 2
Midland Railway 2½ % Debenture Stock (*less* tax £40)		120 0 0
Caledonian Railway 4 % Debenture Stock (*less* tax £27 16s.)		83 8 0
Consols (*less* tax £8 5s. 8d.)		24 18 0
War Loan 5 %		19 5 1
,, Legacy from the late Sir C. Cuffe		10 0 0
		£1,279 11 8

EXPENDITURE.	£ s. d.
By Grants	755 0 0
,, Purchase of £200 War Loan 5 %	190 0 0
,, ,, £39 9s. 6d. War Loan 5 %	37 10 1
,, Bankers' Charges and Cheque Book	0 5 0
	£982 15 1
,, Balance at Bankers	296 16 7
	£1,279 11 8

Present price of following Securities—

£6,667 London and North Western Railway 3 % Debenture Stock, price about 60, value	£4,000 4 0
£6,666 North Eastern Railway 3 % Debenture Stock, price about 59, value	3,932 18 10
£6,400 Midland Railway 3½ % Debenture Stock, price about 50, value	3,200 0 0
£2,780 Caledonian Railway 4 % Debenture Stock, price about 73 ex. d., value	2,029 8 0

INVESTMENTS.	£ s. d.
London & North Western Railway 3 % Debenture Stock	6,667 0 0
North Eastern Railway 3 % Debenture Stock	6,666 0 0
Midland Railway 2½ % Debenture Stock	6,400 0 0
Caledonian Railway 4 % Debenture Stock	2,780 0 0
Consols	1,327 7 9
War Loan 5 % £450	427 10 1
	£24,267 17 10

We have compared the above statement with the books and vouchers relating thereto, and certify it to be correct. We have verified the Bank Balance and the Investments.

Portland House,
Basinghall Street, E.C.,
April 30, 1918.

(*Signed*) EVANS, PEIRSON & CO.,
Chartered Accountants.

ARMY MEDICAL OFFICERS' WIDOWS AND ORPHANS FUND.

SUMMARY OF THE PROCEEDINGS OF THE ONE HUNDRED AND THIRD ANNUAL GENERAL MEETING, WHICH WAS HELD AT THE ROYAL ARMY MEDICAL COLLEGE ON MAY 13, 1918.

Present:

Deputy Surg.-Gen. W. G. Don, Vice-President, in the Chair.
Surg.-Gen. Sir H. R. Whitehead, K.C.B.
Surg.-Gen. Sir M. W. Russell, K.C.M.G., C.B.
Major-Gen. J. J. Gerrard, C.B.
Col. W. T. Martin.
Col. Sir W. B. Leishman, K.C.M.G., C.B., F.R.S., K.H.P.
Lieut.-Col. J. Stevenson (a Trustee).
Lieut.-Col J. More Reid.
Lieut.-Col. G. S. Mansfield.

Letters regretting their inability to attend were read from Surg.-Gen. W. S. M. Price, and from Lieut.-Col. P. S. O'Reilly.

(1) The Minutes of the previous Annual General Meeting were read and confirmed.

(2) The Accounts and Report for the year 1917 were examined and adopted unanimously.

(3) Messrs. Deloitte and Co. were re-appointed Auditors for the current year.

(4) The election by the Committee, under Rule XXVI, of Surg.-Gen. Sir H. R. Whitehead, K.C.B., as a member thereof in place of Lieut.-Col. R. J. L. Fayle, D.S.O., resigned, was confirmed.

Major-Gen J. J. Gerrard, C.B., was elected a member of the Committee for the coming three years in the place of Col. Sir W. H. Horrocks, K.C.M.G., C.B., who retires at the expiration of his period of office.

The Meeting expressed much regret at the death of the late Mr. H. W. Andras, F.I.A., Consulting Actuary to the Society. (A resolution of condolence had been already sent by the Committee to his widow.)

Sir Michael Russell advocated the reduction, or abolition, of the present extra War charge. Under the Rules the Committe must be guided in this matter by the advice of the Actuary.

NOTICE.

This Fund provides annuities of £50 a year during widowhood, to the widow of the marriage, during which the subscription of a married member began. In the event of the death of the widow this annuity is continued to the children of such marriage until the youngest attain the age of 21 years. It also continues for their benefit, up to the same age, if the widow re-marries. Furthermore, should the wife of the subscriber predecease him, it will be optional for him to continue the subscription he had been paying as a married member, in order to provide an annuity similar to the above for the children of the marriage, until the youngest shall have attained the age of 21 years.

Provision is also made whereby a part of the surplus at any quinquennial valuation may be applied for the benefit of members, or their wives, or orphan children. Thus, by the appropriations of surplus at the valuations of December 31, 1910 and 1915, the prospective widows of first-class married members on the books at those dates, will receive, during this current quinquennium, £200 and £100 respectively at the death of their husbands, their annuities being also increased to the statutory limit of £52.

Examples of the rates of annual subscription are :—

Husband's age	Wife's age	Annual subscription
25	20	£13 8 5
30	27	£14 6 1
36	33	£16 17 2
46	40	£22 12 6
50	45	£24 9 5

The present extra War charge, which is subject to revision, is 25 guineas per annum, in addition to the normal annual subscription according to scale. Only Regular officers are eligible for membership.

Unmarried officers may become members by paying £2 yearly, and can thus reduce the rate of their subscriptions when married.

The Secretary will be glad to give any further information as to details.

J. T. CLAPHAM,
Captain,
Secretary.

3, *Homefield Road,*
Wimbledon, S.W. 19.
May, 1918.

ROYAL ARMY MEDICAL CORPS CENTRAL MESS FUND.

SUMMARY OF PROCEEDINGS OF A MEETING OF COMMITTEE HELD AT THE ROYAL ARMY MEDICAL COLLEGE ON APRIL 29, 1918.

Present:

Lieut.-Col. D. Harvey, C.M.G., representing London, in the Chair.
Major W. A. Ward, representing Aldershot.
Capt. H. S. Dickson, representing Woolwich.

(1) The Minutes of the Meeting of November 14, 1917, were read and confirmed.

(2) The Accounts and Report for the year 1917-18 were examined and adopted unanimously.

(3) A letter was considered from Mess President, Depot, Royal Army Medical Corps, Blackpool, stating that a Mess was to be opened in Blackpool, with a branch in camp at Squires Gate during the summer, and asking for a grant of £50 in aid of formation expenses.

(4) The question was considered of continuing the grant to the Aldershot Mess for maintenance purposes. Major Ward said the number of dining members had not increased since the original grant was made, a year ago, and that the funds available were quite inadequate for the maintenance of the Mess, apart from the help given by the Central Fund. The furniture, etc., of this Mess belongs to it and is not repairable by Government. The Committee considered that it was most desirable that the Mess property be kept in proper order and sanctioned a grant of £5 a month, payable by quarterly instalments in advance, for the year beginning April 1, 1918.

(5) The Hon. Secretary of the Aldershot Mess reported that, at present, there were sufficient means available for helping Mrs. Stacey, widow of the late Mess waiter, Mr. George Stacey.

(6) The Hon. Secretary of the London Mess stated that as regards the collection of heads which Lieut.-Col Sir J. S. Rogers had presented to that Mess there was no present opportunity of their being brought from Egypt.

(7) The Hon. Secretary having reported that there would probably be some surplus cash available for investment, it was resolved that the Chairman and Honorary Secretary be empowered to invest any available cash surplus, over and above the necessary balance at the bank, in either five per cent National War Bonds, five per cent National War Loan 1924/47 and in any new loan which may be issued, as may be considered most desirable by Messrs. Holt and Co. The Bonds to be held, as before, by Messrs. Holt and Co. on behalf of the Fund.

(8) Payment of the audit fee to Mr. E. T. Gann was sanctioned.

J. T. CLAPHAM,
Captain,
Hon. Secretary.

3, *Homefield Road,*
Wimbledon.

AUXILIARY ROYAL ARMY MEDICAL CORPS FUNDS.

THE usual Quarterly Meeting of the Committee was held at 11, Chandos Street, W. 1, on July 12. There were present: Major Maclean in the Chair, several members, including Major-Gen. T. H. Goodwin, Director-General Medical Services, the Hon. Treasurer and the Hon. Secretary.

From the Benevolent Branch for the relief of children of Officers of the Auxiliary Royal Army Medical Corps, who died as a result of the present war, grants were made in three cases. The amount granted was £176.

Grants from the Relief Branch for the relief of the widows and orphans of the Rank and File of the Auxiliary Royal Army Medical Corps were also made.

Subscriptions and applications for relief from either Branch should be made to the Hon. Secretary of the Auxiliary Royal Army Medical Corps Funds.

11, *Chandos Street,*
Cavendish Square, W. 1.

MEMORIAL TO LIEUT.-COL. H. MOORE, D.S.O., M.C., ROYAL ARMY MEDICAL CORPS.

A NUMBER of the friends and pupils of the late Lieut.-Col. Henry Moore, M.C., D.S.O., Royal Army Medical Corps, have decided to raise a Fund to perpetuate his memory by endowing a bed under his name in the Royal City of Dublin Hospital, where he spent the greater part of his professional life as student, house surgeon, and visiting surgeon. Would those willing to assist kindly communicate with Mr. G. Jameson Johnson at the hospital.

ROYAL ARMY MEDICAL CORPS COMFORTS AND PRISONERS' OF WAR FUND.

(OFFICIAL CARE COMMITTEE RECOGNIZED BY THE WAR OFFICE FOR THE ROYAL ARMY MEDICAL CORPS.)

THE following is a second list of contributions from companies and units at home and abroad to the Prisoners of War Fund received up to the end of April, 1918. It is hoped to publish further lists at an early date.

Information has recently been received that a large number of British Prisoners of War arrived at a certain camp all wounded, but the narrator adds that thanks to parcels from home, however, they were well fed and not forced like other prisoners to live on horse-chestnut soup and almost inedible bread.

This news, coming as it does from an independent source, gives us good hope that the parcels for all branches of the British Army, including the Royal Army Medical Corps, are regularly received, and this is borne out by the letters coming to the Ladies' Committee from the men themselves and from their relatives.

R.A.M.C. College,
Grosvenor Road, London, S.W. 1,
June 17, 1918.

E. M. WILSON,
Hon. Treasurer, R.A.M.C. Comforts and Prisoners of War Fund.

SECOND LIST.

LIST OF COMPANIES AND UNITS, AT HOME AND ABROAD CONTRIBUTIONS TO PRISONERS OF WAR FUND IN 1918.

April.	£	s.	d.
No. 6 Company R.A.M.C. and Detachments	75	11	9
R.A.M.C., Netley	20	0	0
No. 2 Company, Aldershot	10	0	0
12 and 34 Companies, Woolwich	30	0	0
43rd Field Ambulance	40	0	0
111th Field Ambulance ..100 fr.	3	13	8
4th Cavalry Field Ambulance	4	0	0
4th Northern General Hospital, Lincoln	25	0	0
38th Field Ambulance	20	0	0
Rugeley Camp	5	0	0
1st and 2nd Training Brigades, Blackpool	8	18	10
1st Training Battalion, Blackpool	5	0	0
2nd Training Battalion, Blackpool	5	0	0
R.A.M.C. Detachment, Southampton Docks	10	0	0
20th Company, Tidworth	2	2	0
Sports Account, Blackpool	9	13	6
2/1st Wessex Field Ambulance	10	10	0
1/4th South Lancashire Regt.	9	4	11
3rd Training Battalion, Blackpool	5	0	0
90th Field Ambulance	10	10	0
2/2nd West Riding Field Ambulance	10	0	0
134th Field Ambulance	5	0	0
26th Field Ambulance	4	4	0
P.O.W. Hospital, Lichfield	50	0	0
Regimental Institutes, Blackpool	300	0	0
10th General Hospital	39	8	11
1/3rd Highland Field Ambulance ..200 fr.	7	7	4
2/1st London Field Ambulance	18	6	8
2/3rd Wessex Field Ambulance	9	5	0
3rd Casualty Clearing Station	14	0	0
Malta Detachments	15	0	0

	£	s.	d.
11th Stationary Hospital, France	5	0	0
42nd Field Ambulance	36	13	6
54th Field Ambulance	7	10	0
62nd Casualty Clearing Station	5	0	0
14th Stationary Hospital	11	8	5
5th General Hospital	22	10	0
129th Field Ambulance	10	0	0
10th Field Ambulance	5	0	0
Military Hospital, Rugeley	9	0	0
51st Highland Division 800 fr. and	10	0	0
22nd General Hospital	69	4	6
No. 10 Stationary Hospital	50	0	0
50th Stationary Hospital	6	9	0
2/3rd East Lancashire Field Ambulance .. 1,000 fr.			
12th Casualty Clearing Station	26	12	8
26th General Hospital	26	12	9
104th Field Ambulance (450 fr.)			
1st Southern General Hospital (T.F.)	60	0	0
101st Field Ambulance (100 fr.)	3	13	8
12th St. Louis, U.S.A. General Hospital	7	0	0
33rd Field Ambulance (580 fr.)			
36th Casualty Clearing Station	5	0	0
1/3rd East Lancashire Field Ambulance	12	3	0
64th Casualty Clearing Station	16	16	5
25th Ambulance Train	5	5	0
52nd General Hospital	13	7	0
132nd Field Ambulance 700 fr. and	4	0	0
43rd Casualty Clearing Station (550 fr.)			
56th Casualty Clearing Station (500 fr.)			
Craig Lockhart Hospital, Officers	6	0	0
No. 4 Field Ambulance (300 fr.)			

ROYAL ARMY MEDICAL COLLEGE.

LIST OF BOOKS ADDED TO THE LIBRARY DURING THE MONTHS OF APRIL, MAY AND JUNE, 1918.

Title of Work and Author	Edition	Date	How obtained
An Index of Differential Diagnosis of Main Symptoms. Edited by Herbert French, M.A., M.D.	3rd	1917	Library Grant.
Lectures on Massage and Electricity in the Treatment of Disease. By T. S. Dowse, M.D.		1906	,, ,,
An Index of Treatment. By Various Writers. Edited by Robert Hutchison, M.D., and James Sherren, F.R.C.S.	7th	1917	,, ,,
Physiological Abstracts. Edited by W. D. Halliburton. Vol. i., No. 1 to Vol. iii., No. 3.		1916-18	,, ,,
Anti-Malaria Work in Macedonia. By W. G. Willoughby and Louis Cassidy		1918	,, ,,
The Essentials of Chemical Physiology. By W. D. Halliburton, M.D., F.R.S.	9th	1916	,, ,,
American Addresses. By Sir Berkeley Moynihan, M.S., F.R.C.S.		1917	,, ,,
Handbook of Operative Surgery. By W. I. de C. Wheeler, B.A., M.D.	3rd	1918	,, ,,
Field Service Notes for Royal Army Medical Corps. By Colonel T. H. Goodwin, A.M.S.		1918	,, ,,
Surgical Therapeutics and Operative Technique. By E. Doyen. English Edition by H. Spencer Browne. Vol. ii.		1918	,, ,,
Analytical Chemistry. By Treadwell and Hall. Vol. i.		1916	,, ,,
How to Treat by Suggestion. By E. L. Ash, M.S. ..		1914	,, ,,
The Rhymes of a Red Cross Man. By R. W. Service ..		1918	,, ,,
Who's Who		1918	,, ,,
The New Hazell Annual and Almanack		1918	,, ,,
Malingering. By Sir John Collie	2nd	1917	Editor, Journal.
Malingering. By Jones and Llewellyn		1917	,, ,,
Hygiene and Public Health. By Parkes and Kenwood ..	6th	1917	,, ,,
Laboratory Studies in Tropical Medicine. By Daniels and Newham	4th	1918	,, ,,
Epidemics Resulting from War. By Dr. F. Prinzing ..		1916	,, ,,
The Drink Problem of To-Day. Edited by T. N. Kelynack		1916	,, ,,
Construction and Management of a General Hospital. By Donald Mackintosh		1916	,, ,,
On the Road to Kut. By Black Tab		1917	,, ,,
At Suvla Bay. By John Hargrave		1916	,, ,,
The Wounded French Soldier. By D. C. Calthrop ..		1916	,, ,,
Lord Lister. By Sir R. J. Godlee, Bt.		1917	,, ,,
Emergency Surgery. By John W. Sluss, A.M., M.D. ..	4th	1917	,, ,,
The Edinburgh Review, April		1918	,, ,,
Tropical Diseases. By Sir P. Manson, G.C.M.G... ..	6th	1917	,, ,,
Ambulance No. 10. By L. Buswell		1916	,, ,,
Minor Surgery and Bandaging. By M. Davies (Heath and Pollard)	16th	1917	,, ,,
The Practitioner's Pocket Pharmacology and Formulary. By L. Freyberger		1917	,, ,,
Memoranda on Army General Hospital Administration. By Various Authors. Edited by Lieut.-Col. P. Mitchell, M.D.		1917	,, ,,
The Causation of Sex in Man. By E. R. Dawson ..	2nd	1917	,, ,,
Library of Congress. Report for the Fiscal Year ending June 30, 1917		1917	,, ,,

LIST OF BOOKS ADDED TO THE LIBRARY—*Continued.*

Title of Work and Author	Edition	Date	How obtained
Medical Research Committee. Reports of the Air Medical Investigation Committee. No. 1. The Oxygen Needs of Flying officers		1918	Medical Research Committee.
No. 2. I.—Medical Aspects of High Flying II.—Procedure for Testing the Effects of Oxygen Want III.—Observations on the Cardio-vascular and Nervous System of Successful Pilots		1918	,, ,,
No. 3. Flying Stress		1918	,, ,,
Medical Research Committee. Report to the Committee on War Nephritis. By H. MacLean, M.D., D.Sc., Hon. Captain R.A.M.C.		1918	,, ,,
Reports of the Anaerobe Committee. No. 1. The Demonstration of Anaerobes in Wounds of recent date		1918	,, ,,
Reports of the Special Investigation Committee on Surgical Shock and Allied Conditions. No. 4. Memorandum on Blood Transfusion. By Captain Oswald H. Robertson, M.D.R.C., U.S.A.		1918	,, ,,
Reports of the Chemical Warfare Medical Committee:— No. 1. Notes on the Pathology and Treatment of the Effects of Pulmonary Irritant Gases		1918	,, ,,
No. 2. The Historical Effects Produced by Gas Poisoning and their Significance		1918	,, ,,
No. 3. The Symptoms and Treatment of the late Effects of Gas Poisoning		1918	,, ,,
No. 4. Polycythæmia after Gas Poisoning and the Effect of Oxygen Administration in Chambers in Treatment of Chronic Cases		1918	,, ,,
No. 5. The Reflex Restriction of Respiration after Gas Poisoning		1918	,, ,,
No. 6. Investigations into the Reaction of the Blood after Gas Poisoning, and the Results of the Administration of Saline and other substances. The Effects of Bleeding and of the injection of Calcium Chloride		1918	,, ,,
No. 7. Changes observed in the Heart and Circulation, and the General After Effects of Irritant Gas Poisoning		1916	,, ,,
Military Overcrowding and the Meningococcus Carrier. By Capt. J. A. Glover, M.D., D.P.H., R.A.M.C. ..		1918	,, ,,
Memoranda Supplementary to Medical Research Committee, Special Report Series, No. 8 .. .. .. No. 2. A Comparison of Patients with Valvular and Non-valvular Affections. By Thomas Lewis, M.D.		1917	,, ,,
Journal of the Royal Naval Medical Service, April ..		1918	The Editor.
Catalogue of the War Office Library. Part III (Subject Index). Sixth Annual Supplement (January to December, 1917). Compiled by F. J. Hudleston		1918	War Office.
Year Book of the Royal Society		1918	Royal Society.
Britsh Medicine in the War, 1914-1917. Essays, &c., Collected out of the *British Medical Journal*, April to October, 1917		1917	Presented by Surg.-Gen. Sir D. Bruce, K.C.B., F.R.S.
The Systematic Treatment of Gonorrhœa. By Capt. N. P. L. Lumb, R.A.M.C.			Presented by the Author.
JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, vol. viii, 1907, to vol. xxix, 1917 (unbound)..		1907-17	Presented by Surg.-Gen. W.S.M. Price, A.M.S.
A Text-book of Radiology (X-Rays). By E. R. Morton, M.D.	2nd	1918	Presented by the Author.
Meteorology of Australia. Results of Rainfall Observations made in Queensland. By H. A. Hunt		1914	Presented by Major L. Lanyon Owen, R.A.M.C.
The Geographical Journal, August, 1917, to June, 1918 ..		1917-18	Presented by Col. R. J. S. Simpson, C.B., C.M.G., A.M.S.

EXCHANGES, &c.

The charge for inserting Notices respecting Exchanges in the Royal Army Medical Corps is 5/- for not more than five lines, which should be forwarded by Cheque or P.O.O., with the notice, to Messrs. G. STREET and CO., Ltd., 8, *Serle Street, London, W.C., not later than the 22nd of the month.*

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are inserted free of charge to subscribers and members of the Corps. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "Journal of the Royal Army Medical Corps," 324, Adastral House, Victoria Embankment, E.C. 4.

The following publications have been received:—

British: St. Bartholomew's Hospital Journal, Guy's Hospital Gazette, The Journal of State Medicine, The Practitioner, Liverpool School of Tropical Medicine, The Hospital, The Medical Press and Circular, Journal of the United Service Institution of India, The Indian Medical Gazette, The Quarterly Journal of Medicine, The Journal of Tropical Medicine and Hygiene, Surgery, Gynæcology, and Obstetrics, Public Health, The Medical Journal of Australia, The Royal Engineer's Journal, Proceedings of the Royal Society of Medicine, Edinburgh Medical Journal, Abstracts of Bacteriology, The British Journal of Tuberculosis, The Army Service Corps Journal, The Medical Review.

Foreign: The Military Surgeon, Bulletin de l'Institut Pasteur, Bulletin of the Johns Hopkins Hospital, Bulletin de la Société de Pathologie Exotique, L'Ospedale Maggiore, Office International d'Hygiène Publique, Archives Médicales Belges, Giornale di Medicina Militare, Annali di Medicina Navale e Coloniale, Archives de Médecine et Pharmacie Navales, Colonies et Marine, Norsk Tidskrift for Militaermedicin, United States Department of Agriculture.

A free issue of twenty-five reprints will be made to contributors of Original Communications, and of twenty-five excerpts of Lectures, Travels and Proceedings of the United Services Medical Society.

Any demand for reprints, additional to the above, or for excerpts, must be forwarded at the time of submission of the article for publication, and will be charged for at the following rates, and additional copies at proportionate rates:—

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	8	0 10 0	0 4 10	7 10	3 11	6 7	2 5
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Cases for Binding Volumes.—Strong and useful cases for binding can be obtained from the publishers at the undermentioned rates:—

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The above figures are subject to 25 per cent increase.

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The back outside cover is not available for advertisements.

MANAGER'S NOTICES.

The Journal of the Royal Army Medical Corps is published monthly, six months constituting one volume, a volume commencing on 1st July and 1st January of each year.

The Annual Subscription is £1 (which includes postage), and should commence either on 1st July or 1st January; but if a subscriber wishes to commence at any other month he may do so by paying for the odd months between 1st July and 1st January at the rate of 1s. 8d. (one shilling and eightpence) per copy. (All subscriptions are payable in advance.)

Single copies can be obtained at the rate of 2s. per copy.

The Corps News is also issued separately from the Journal, and can be subscribed for at the rate of 2s. (two shillings) per annum, including postage. Subscriptions should commence from 1st July each year; but if intending subscribers wish to commence from any other month, they may do so by paying for the odd months at the rate of 2d. per copy. (All subscriptions are payable in advance.)

Officers of the Royal Army Medical Corps possessing Diplomas in Public Health, etc., are kindly requested to register their special qualifications at the War Office. Letters of complaint are frequently received from officers stating that their special qualifications have not been shown in the Distribution List which is published as a supplement to the Journal in April and October of each year. As, however, the particulars of this list are supplied from official sources, officers are reminded that unless the possession of Diplomas, etc., has been registered at the War Office, no entry of such qualifications can be recorded in the Distribution List.

Letters notifying change of address should be sent to the Hon. Manager, "Journal of the Royal Army Medical Corps," 25, Adastral House, Victoria Embankment, E.C. 4, and must reach there not later than the 20th of each month for the alteration to be made for the following month's issue.

It is requested that all Cheques or Postal Orders for Subscriptions to the Journal, Corps News, Reprints, etc., be crossed "Holt & Co.," and made payable to the "Hon. Manager, Journal R.A.M.C.," and not to any individual personally.

All communications for the Hon. Manager regarding subscriptions, etc., should be addressed to

The Hon. Manager,
"Journal of the Royal Army Medical Corps,"
25, Adastral House, Victoria Embankment, E.C.4.

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

August, 1918.

EXTRACTS FROM THE "LONDON GAZETTE."

War Office,
July 5, 1918.

With reference to the awards conferred as announced in the *London Gazette*, dated February 4, 1918, the following are the statements of service for which the decorations were conferred :—

Awarded a Bar to the Distinguished Service Order.

Major (Temp. Lieut.-Col.) Arthur Carr Osburn, D.S.O., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. On seeing the enemy approaching close to his dressing station he carried out the evacuation of the wounded under heavy shell and rifle fire in the coolest and most gallant manner. Having cleared away all cases by ambulance train and cars he re-established his dressing station farther in the rear. As officer commanding bearer divisions, he constantly inspected his line of bearer posts and forward dressing stations under heavy fire. The successful evacuation of the wounded from the divisional front was due to his careful organization and fearless supervision under the most trying conditions. His was an example of gallantry, courage, and resource worthy of the highest praise.

Awarded the Distinguished Service Order.

Temp. Capt. Ferguson Fitton Carr-Harris, M.D., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. Hearing that ten men of another battalion were lying wounded in front of the position, he volunteered on completion of the relief to go to their rescue. He was out for eight hours of the night, found nine of the men alive, took two of them back to headquarters, and organized the rescue of the remainder. He showed great coolness and self-sacrifice.

Major (Temp. Lieut.-Col.) Charles Algernon Stidston, M.D., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty when his dressing station was very heavily shelled throughout the whole day and received several direct hits. It was impossible to remove the wounded, and throughout the day he moved about continuously arranging for their safety with utter disregard of danger. It was owing to his fearless example and splendid organization that all the wounded were finally removed without further casualties.

Awarded the Bar to the Military Cross.

Capt. Cuthbert Delaval Shafto Agassiz, M.C., M.D., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty when in charge of a bearer post. He remained working throughout an intense bombardment, in which some of his bearers were killed and wounded while loading ambulance cars. He was compelled to remove to dug-outs, and there persisted in his work until shelled out. Though driven back three times by machine-gun fire and gas shell barrages, he succeeded in reaching the aid posts with his bearers, and removed all the wounded.

Temp. Capt. Arthur Joseph Blake, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He did splendid work in collecting and evacuating the wounded, working throughout in the open regardless of the heavy hostile fire. Later, he did excellent work tending the wounded of several units, going out after dusk to bring in wounded men from the front of our line. During the withdrawal he took out a party and carried back seven stretcher cases for a distance of three miles, thereby preventing these men falling into enemy hands. He has at all times carried out his duties with fearlessness and courage.

Capt. Eric Alfred Charles Fazan, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. During very heavy fighting his aid post twice passed into the hands of the enemy. Although all communication with him by day was cut off for two days, he remained with his wounded, 235 of whom passed through his hands. It was due to his determination that every wounded man and all the personnel of his aid post were safely removed.

Capt. Samuel McCausland, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He was in charge of bearers evacuating the wounded at a village under heavy shell and machine-gun fire. When almost the whole village was in the hands of the enemy he continued to supervise the collection of wounded, and it was mainly due to him and his bearers that they were all so speedily removed. In an attack he performed splendid work by clearing wounded of his brigade under most difficult conditions.

Temp. Capt. James Wallace Macfarlane, M.C., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. During a heavy bombardment of a battery position he assisted another officer and a sergeant in putting out the flames in a gun pit which had caught fire. By his prompt assistance the gun was saved from serious damage and the ammunition from destruction.

Capt. Joseph Stephen Wallace, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. Whilst in charge of an advanced dressing station and bearer squads, he frequently visited the regimental aid posts in the line and skilfully arranged his bearer squads to the best advantage. He also personally conducted ambulance cars to very advanced positions, thus being able to get a very large number of cases removed to safety in a short time. His coolness and courage during the whole period were a splendid example to his men.

Awarded the Military Cross.

Capt. Robert Vacy Clifford Ash, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. When the enemy attacked and almost surrounded his dressing station he remained at his post under intense machine-gun and shell fire, attending the wounded with complete disregard of danger. He got all the wounded safely away, and was instrumental in saving the transport and a large part of the personnel of the field ambulance. He then volunteered to return at once to the firing line, where he did excellent work in a most exposed position. He set a magnificent example of courage and devotion to duty.

Capt. Arthur Joseph Beveridge, M.B., Royal Army Medical Corps, Special Reserve.

For conspicuous gallantry and devotion to duty. His dressing station was heavily shelled during an engagement, but owing to his determination, courage and initiative, a large number of wounded were attended to and evacuated from the danger zone.

Capt. John Holliday Blackburn, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. When eighty stretcher cases as well as a number of walking cases were handed over by another division, and owing to heavy shelling it was impossible to move them during the day, he took forward an ambulance as close to the position as possible and organized the evacuation of the wounded. He showed splendid determination and resource.

Temp. Capt. Joseph Victor Cope, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He was in charge of stretcher-bearers in an exposed position, which was subjected to intense fire. Though he was suffering from gas he remained at his post for two days, setting such a magnificent example to his men that the evacuation of the wounded went on throughout the bombardment. By his courage and devotion to duty he saved many lives.

Temp. Capt. David McMurray Dickson, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty in tending the wounded under heavy shell and machine-gun fire. He was continually out during the day searching the battlefield for wounded. He showed courage of a high order on this and many other occasions.

Lieut. S. Dutt, Indian Medical Service.

For conspicuous gallantry and devotion to duty. He worked indefatigably and attended a large number of wounded belonging to various units at the aid post, which was under heavy shell and machine-gun fire, and rifle fire. His absolute coolness and steady devotion to duty were a splendid example to all.

Capt. (Temp. Major) John Douglas Fiddes, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in continuing to dress the wounded under heavy shell fire at the advanced dressing station. Although the dressing station received direct hits, he continued to work and saved many lives by his courage and untiring energy.

Capt. John Henry Pearson Fraser, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in organizing a new line of evacuation when the original line was blocked by the initial success of the enemy counter-attack. Many wounded had collected, but he got away over 100 stretcher cases, working unceasingly in the open thirty-six hours.

Capt. Philip Jacob Gaffikin, M.B., Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty while in charge of stretcher-bearers during an engagement. He directed the removal of the wounded under heavy shell fire, and showed great courage and resource.

Temp. Capt. Hugh Bernard German, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. When his dressing station was heavily shelled he organized the removal of thirty-eight stretcher cases. He also rescued several wounded of another division under heavy shell fire. He established dressing stations without delay at various stages in an advance of four or five miles, and so enabled the wounded to be rapidly evacuated.

Temp. Capt. Frank Arthur Grange, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked night and day without any rest, attending wounded from all units under continuous shell fire. He also went up to the front line under heavy fire to attend to a severely wounded man, and succeeded in getting him away.

Temp. Capt. Edwin Allan Thomas Green, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked with ceaseless energy, attending and evacuating the wounded. He moved his aid post forward, and worked under heavy shell fire till the enemy were within a few yards of his aid post. He evacuated all save a few bad cases who could not be moved. His courage and presence of mind saved a large number of wounded falling into enemy hands.

Temp.-Lieut. Arthur Collis Hallowes, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty when in charge of bearers. He succeeded in rapidly evacuating all the wounded under very difficult conditions. He attended to a severely wounded officer under machine-gun fire.

Temp. Capt. James Philips Jones, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked in the line for a fortnight organizing advanced dressing stations and bearer systems. During an enemy attack he was cut off from battalion headquarters, but established an aid post and worked under heavy fire in the open for thirty-six hours, attending to a large number of wounded. He showed the greatest courage and endurance throughout.

Temp. Capt. Frederick Bennett Julian, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He remained at his post attending to the wounded during an engagement with great courage and determination, though suffering severely from the effects of gas.

Temp. Capt. Arthur Griffith Hairland-Jones, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. During the operations he repeatedly reconnoitered the roads under heavy shell fire. By his example and leading he established communication with the most forward dressing stations, and succeeded in bringing up his ambulances and rapidly evacuating the wounded from very exposed positions.

Lieut. (Temp. Capt.) William Wyllie MacNaught, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He organized a bearer party during an action, and collected and cleared many wounded under heavy shell fire. His prompt and gallant action saved many lives.

Temp. Capt. James Manuel, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. During an enemy attack he showed the greatest courage in attending to wounded men who were lying in shell holes exposed to enfilade machine-gun fire. With complete disregard of his own safety he went from one shell hole to to another attending to the wounded, and continued at this work after he had been wounded himself.

Lieut. John Marshall, M.B., Royal Army Medical Corps (Special Reserve.)
For conspicuous gallantry and devotion to duty. When in charge of stretcher squads, he succeeded in evacuating all the wounded during a critical period of a withdrawal from a village, frequently going forward beyond the firing line in order to accomplish his task.

Temp. Capt. Duncan John McAfee, M.D., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. When two attempts to remove a wounded man from a regimental aid post had failed owing to the stretcher-bearers being killed, he at once led forward a third party and succeeded in getting all the wounded back to a place of safety under very heavy shell fire. He showed splendid courage and self-sacrifice.

Temp. Capt. Frederick Buick McCarter, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. When after an attack there were heavy casualties, he continued to attend the wounded in an open road enfiladed by machine-gun fire, and undoubtedly saved many lives.

Temp. Capt. James Allen Montgomery, M.D., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. On his own initiative he organized a line of stretcher-bearers to search "No Man's Land." He personally took charge of the party, and was often under heavy fire, and within a few feet of the enemy.

Temp. Capt. George Morris, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He moved his aid post forward and worked there ceaselessly day and night until the battalion was relieved. The aid post three times sustained direct hits from the enemy shell, but he immediately found another aid post and continued to dress the wounded under continual shell fire.

Temp. Capt. David Assur Henry Moss, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in working continually at his aid post during three days' operations under heavy shelling. Frequently shells dropped close by killing and wounding several men, but he remained at his work and showed the utmost indifference to danger.

Temp. Capt. Evan Edward Owens, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He carried on his work in a crowded aid post under continual shell fire with the greatest coolness and determination. Though blinded by gas, he continued for four hours to supervise the treatment of stretcher cases.

Capt. Harold Dobson Pickles, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty when in charge of bearers. When a number of wounded were lying in a cellar and the adjoining building, in which a number of "P" bombs and S.A.A. were stored, was set on fire, he at once went to extinguish it and remove the ammunition While doing so he, a non-commissioned officer, and a man were wounded, but he got them both under cover. An hour later a second fire occurred, and he again went to extinguish it. For three days he worked without rest superintending the evacuation of the wounded.

Capt. John Alexander Pridham, Royal Army Medical Corps, Special Reserve.
For conspicuous gallantry and devotion to duty. He was in charge of an advanced dressing station where there were a large number of wounded when the enemy attacked. The task of removing them was an extremely difficult one, owing to the proximity of the enemy and heavy shell and machine-gun fire, but he carried it out sucessfully, remaining on the spot until all the wounded had been evacuated. By his courage and devotion to duty he was the means of saving many lives.

Capt. William Robertson, M.B., Royal Army Medical Corps.
For conspicious gallantry and devotion to duty in attending to the wounded in the open during an attack when the battalion was held up by heavy machine-gun and rifle fire, and several casualties occurred. When the two companies were cut off by heavy machine-gun fire and sustained casualties, he volunteered to try and reach them. His conduct throughout was most courageous.

Temp. Capt. Lionel Matthew Rowlette, D.S.O., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked untiringly attending to the wounded under very heavy fire throughout the day, and set a magnificent example of courage and coolness to all.

Temp. Capt. Cedric Russell, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked in the open attending to the wounded during an engagement, with complete disregard to danger under heavy shell fire.

Temp. Capt. Robert Rutherford, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked continuously day and night at his aid post under continual shell fire. When the aid post had twice sustained direct hits and he himself was suffering from severe concussion, he established a new aid post and remained at work under heavy fire.

Temp. Capt. Brian Herbert Swift, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. When the front line was driven back close to the battery positions he moved about throughout the day from one battery to another wherever his services were needed, with utter disregard to danger under heavy fire. He remained

on the spot until the battalion had withdrawn, and was the last to leave the position. He set a splendid example of courage and determination.

Capt. Arthur Peregrine Thomson, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked untiringly and with utter disregard of danger, attending to the wounded under heavy fire for several days during an engagement. It was entirely due to his efforts and example that a large number of wounded were safely evacuated.

Capt. George Dibbs King Waldron, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty when in charge of a party of bearers. Though several times blown over by bursting shells, he succeeded in evacuating all the wounded of the brigade. On one occasion he assisted to carry a stretcher case through a heavy barrage. He continued to work till utterly exhausted.

Capt. Douglas Larmer Wall, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He attended the wounded under heavy shell fire in most exposed positions. He showed great courage and determination.

Capt. James Anderson Young, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. When the building in which a number of wounded were lying was heavily shelled, with the assistance of another man he succeeded in carrying all the wounded into a cellar, though shells were continually bursting in the building. He showed the greatest courage and determination.

Capt. James Carruthers Young, M.D., Royal Army Medical Corps, Special Reserve.
For conspicuous gallantry and devotion to duty when in charge of an advanced dressing station. When the village was continuously shelled he personally superintended the removal of many of the wounded to a safer position. During the night he had them all evacuated and established a new dressing station.

No. 32610 Serjt.-Major Frank Hulbert, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He showed complete disregard of danger while superintending the evacuation of the wounded. He worked continuously for seventy-two hours under heavy shell fire, and set a splendid example of pluck and initiative in removing the wounded from a barn which was being heavily shelled.

Canadian Force.

Capt. Edgar Douglas, Army Medical Corps.
For conspicuous gallantry and devotion to duty. He directed his relay of bearers under heavy shell fire, and though wounded, remained at duty until he was relieved.

Capt. Austin Dwight Irvine, Army Medical Corps.
For conspicuous gallantry and devotion to duty. During four days in the front line he worked day and night attending to the wounded, often under heavy shelling. When casualties occurred during an enemy barrage, without hesitation he left battalion headquarters and went to the assistance of the wounded.

Capt. Gordon Leigh Jepson, Army Medical Corps.
For conspicuous gallantry and devotion to duty. He established an aid post during an attack under heavy shell fire, and for over ten hours attended to the wounded in the open under enemy shelling. When the enemy shelled his position with gas shells, and a number of stretcher cases were lying outside the aid post, he went out at great personal risk and put box respirators on all the wounded, and by his prompt action saved many lives. He showed the greatest courage and self-sacrifice.

Capt. James Grant MacNeill, Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked unceasingly in the open attending to the wounded under heavy shell fire. During a gas shell bombardment he adjusted his own box respirator on a wounded serjeant, and obtained others for a number of stretcher cases who were unable to help themselves. His coolness and courage were a splendid example to all, and undoubtedly saved many lives.

Capt. Wesley Herbert Secord, Army Medical Corps.
For conspicuous gallantry and devotion to duty when in charge of the evacuation of the wounded from the forward area. During a heavy bombardment of gas and other shells he made a tour of the bearer posts to ensure that all anti-gas measures were being employed. He attended to wounded men in the open during the bombardment with complete disregard of danger. His coolness and courage were a splendid example to all.

Capt. William Ewing Sinclair, Army Medical Corps.
For conspicuous gallantry and devotion to duty. When in charge of bearers at the regimental aid post he worked for three days and nights attending to the wounded under heavy fire and in the face of great difficulties. Though suffering severely from the effects of gas he remained at duty and set a magnificent example of courage and coolness to all.

NEW ZEALAND FORCE.

Capt. Rex Carrington Brewster, F.R.C.S., Medical Corps.

For conspicuous gallantry and devotion to duty during an action. Throughout the day he was continually exposed to heavy shell fire while attending to the wounded, and set a splendid example to all ranks by his devotion to duty and contempt of danger.

War Office,
July 6, 1918.

The undermentioned Officers have been brought to the notice of the Secretary of State for War for valuable services rendered in connexion with the War:—

Capt. (Temp. Hon. Lieut.-Col.) D. J. Armour, Royal Army Medical Corps (Captain Royal Army Medical Corps, Special Reserve).

Col. W. H. Horrocks, C.B., M.B., Army Medical Service, retired pay.

Lieut.-Col. F. S. Irvine, D.S.O., M.B., Royal Army Medical Corps.

Temp. Major-Gen. Sir B. G. Moynihan, C.B.

Temp. Col. Sir R. Ross, K.C.B., F.R.S., F.R.C.S., Army Medical Service (Indian Medical Service, retired pay.)

Col. (Temp. Major-Gen.) Stanistreet, C.B., C.M.G., M.B., Army Medical Service.

Temp. Col. A. S. Woodwark, M.D., Army Medical Service.

War Office,
July 12, 1918.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for distinguished services rendered during the course of the campaign.

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

DECORATIONS CONFERRED BY HIS MAJESTY THE KING OF THE BELGIANS.

Croix de Guerre.

ROYAL ARMY MEDICAL CORPS.

Capt. Francis Dighton Annesley, Special Reserve.
Temp. Capt. Andrew Climie, M.B.
Temp. Capt. Roland Arthur Hertslet Fulton, M.B.
Lieut.-Col. Henry Charles Rupert Hime, D.S.O.
Temp. Capt. Gavin Dalzell McClean.
Capt. (Acting Lieut.-Col.) William Tyrrell, D.S.O., M.C., Special Reserve.
Capt. (Acting Lieut.-Col.) William Gordon Wright, D.S.O.
No. 57664 Pte. Maurice William Bell (Burton Stather, near Doncaster).
No. 339298 Staff-Serjt. Wilfred Brooke (Bradford).
No. 46806 Pte. John Henry Brownlee (North Shields).
No. 81627 Pte. (Acting Lance-Cpl.) James Bruce (Edinburgh).
No. 388088 Qmr.-Serjt. James Carney (Darlington).
No. 31005 Staff-Serjt. Alfred Frank Clarke (Bournemouth, E.)
No. 6218 Serjt. (Acting Staff-Serjt.) Alfred William Cockerell (Colchester).
No. 18200 Serjt. (Acting Qmr.-Serjt.) William George Collings (Portsmouth).
No. 301131 Cpl. Frederick William Christie Cooper (Aberdeen).
No. 439018 Staff-Serjt. (Acting Serjt-Major) James Creese (Bristol).
No. 305002 Staff-Serjt. (Temp. Serjt.-Major) Robert Duncan (Dundee).
No. 453510 Pte. John Dunning (Huddersfield).
No. 48826 Pte. Thomas Edwards (Treherbert).
No. 18678 Qmr.-Serjt. (Temp. Serjt.-Major) Lewis Spencer Ellis (Croydon, Surrey).
No. 457355 Lance-Serjt. George Edmund Essex (Exminster, nr. Exeter).
No. 3233 Pte. Martin Flannery (Ballina).
No. 38643 Qmr.-Serjt. (Acting Serjt.-Major) George Michael Fletcher (Sydenham).
No. 37751 Pte. Thomas Garvey (Leeds).
No. 30119 Serjt. Arthur Thomas Gay (Kennington, S.E.).
No. 48775 Pte. John Goodier (Sale).
No. 76654 Pte. Jack Goodwill (Bury).
No. 508024 Serjt. Bernard Percival Hale (Enfield Wash, N.).
No. 43 Pte. Alfred William Harding (Cirencester).
No. 39891 Pte. Hubert James Harding (Bolney).
No. 352256 Cpl. Leonard Holland (Burnley).
No. 446012 Serjt. Edward Honey, D.C.M. (Maidenhead).
No. 43471 Pte. John William Hooson (Leigh).
No. 39213 Serjt. James Ingram (Seaton Delaval).
No. 49467 Serjt. Rowland George Jackson, Cricklewood, N.W.).
No. 3529 Pte. James Jamieson (Glasgow).
No. 337577 Pte. William Charles Jones (Birkenhead).
No. 88583 Pte. George Kemp (Lavenham, Suffolk).
No. 417055 Serjt.-Major Albert Thomas King (Derby).
No. 46092 Pte. Stanley William Kirkham (Egremont, Cheshire).
No. 2009 Cpl. (Acting Serjt.) Herbert Latimer (Middlesborough).
No. 30160 Pte. John McCarthy (Dublin).
No. 1808 Serjt. Wm. John McClay (Woolwich).
No. 81023 Pte. Angus Isaac Mackay (Edinburgh).

No. 30437 Serjt.-Major John Mackenzie (Tayport).
No. 39854 Serjt.-Major Frederick Miller (Acton, W.).
No. 337090 Cpl. George Alexander Morton (Kirkdale).
No. 403203 Pte. Harold Newton (Leeds).
No. 350561 Pte. Grosvenor Nicholson (Manchester).
No. 5537 Pte. Ernest John Perkins (North Littleton).
No. 350007 Staff-Serjt. Thomas Kermode Quayle (Hyde, Lancashire).
No. 54520 Pte. William Rickaby (Kirby Moorside).
No. 354020 Serjt. (Acting Serjt.-Major) Edward Roberts (Manchester).
No. 11405 Qmr. Serjt. (Acting Serjt.-Major) William Scott (Brentford).
No. 563 Pte. (Acting Corporal) Charles Henry Stevens (Grimsby).
No. 31731 Serjt.-Major David Stewart (Glasgow).
No. 47091 Serjt. Walter Denison Strong (Hull).
No. 459314 Pte. Arthur William Lock Thomas (Torquay).
No. 512196 Serjt.-Major Harry Ernest Young (Brockley, S.E.).

Canadian Force Army Medical Corps.

Col. Arthur Edward Ross, C.M.G.
Major James Henry Wood.
No. 33343 Serjt. Thomas Fulthorpe.
No. 7251 Pte. Wm. Ernest May.
No. 2882 Pte. Gordon Stewart Noakes.
No. 241 Serjt. Wilfred Gordon Robinson.
No. 1566 Lance-Serjt. Bertram Robert Smith.
No. 17 Serjt. Eric David Wooster.

New Zealand Force Medical Corps.

Lieut.-Col. James Hardy Neil.
No. 3/210 Serjt. James Gardiner Jackson.
No. 3/172 Serjt. Frank Loftus.

Indian Medical Service.

Col. Courtenay Clarke Manifold, C.B., C.M.G., M.B.

War Office,
July 16, 1918.

His Majesty the King has been graciously pleased to approve of the award of a Second Bar to the Military Medal to the undermentioned Non-commissioned Officer:—

No. 53148 Pte. (Acting Serjt.) E. Broomhall, M.M., Royal Army Medical Corps (Henley). M.M. gazetted October 21, 1916; First Bar gazetted January 22, 1917.)

His Majesty the King has been graciously pleased to approve of the award of a Bar to the Military Medal to the undermentioned Non-commissioned Officers and Men:—

No. 534162 Cpl. J. A. Sellick, M.M., Royal Army Medical Corps (Woolwich). (M.M. gazetted December 21, 1916.)

No. 40842 Pte. (Acting Cpl.) P. McKeown, M.M., Royal Army Medical Corps (Barrow). (M.M. gazetted July 28, 1917.)

No. 1099 Cpl. (Acting Serjt.) A. Walton, M.M., Royal Army Medical Corps (S. Kensington). (M.M. gazetted August 21, 1917.)

No. 341771 Pte. T. R. Singleton, M.M., Royal Army Medical Corps (Carlisle). (M.M. gazetted January 14, 1918.)

No. 8992 Pte. (Acting Lance-Serjt.) W. McGee, M.M., Royal Army Medical Corps (South Shields). (M.M. gazetted June 14, 1918.)

His Majesty the King has been graciously pleased to approve of the award of the Military Medal for Bravery in the Field to the undermentioned Non-commissioned Officers and Men:—

Royal Army Medical Corps.

No. 74870 Pte. E. J. Adams (Reading).
No. 58296 Cpl. F. Adlam (Salisbury).
No. 53894 Pte. A. C. Aplin (Kendal).
No. 69315 W. J. Arnold (St. Mary Cray).
No. 350097 Serjt. N. Ashworth (Bolton).
No. 89458 Pte. E. Ball (Corsham).
No. 352168 Pte. T. Bannister (Montreal).
No. 103964 Pte. J. Barnard (Walkden).
No. 63351 Pte. A. M. Bennett (Bradford).
No. 352105 Lance-Cpl. (Acting Cpl.) W. Boden (Burnley).
No. 417420 Pte. (Lance-Cpl.) J. H. Bott (Derby).
No. 339466 Pte. C. H. Bree (St. Heliers, Jersey).
No. 45539 Pte. J. T. Briggs (Tottenham).
No. 68676 Pte. J. Brooks (Ramsbottom).
No. 46007 Pte. H. Broster (Chester).
No. 368037 Pte. C. Caramaletis (Swansea).
No. 472019 Pte. H. V. Carrington (Luton).
No. 45561 Pte. E. H. Carter (Southall).
No. 341258 Serjt. P. Chesworth (St. Helens).
No. 68251 Pte. C. Chiffince (Battersea).
No. 350467 Pte. C. M. S. Clarke (Manchester).
No. 354034 Serjt. T. Coan (Manchester).
No. 350023 Serjt. J. Colecliffe (Manchester).
No. 36065 Pte. (Acting Cpl.) J. Crowther (Hartlepool).
No. 341529 Pte. J. Cuthbert (Liverpool).
No. 491186 Pte. B. Dakin (Leicester).
No. 344054 Staff-Serjt. J. Dale (Manchester).
No. 47173 Pte. E. Davis (Chichester).
No. 17663 Staff-Serjt. G. Duerden (Folkestone).
No. 459029 Pte. W. J. Elliott (Stonehouse).
No. 33046 Pte. A. E. Ellis (Islington, N.)
No. 1951 Pte. H. Gaiger (Wolverhampton).
No. 68631 Pte. J. L. Gaukroger (Halifax).
No. 35496 Pte. H. J. S. Gibbs (Highgate).

No. 20575 Pte. (Acting Cpl.) F. A. Gregory (Canterbury).
No. 62865 Pte. (Acting Serjt.) A. J. Guerins (Limerick).
No. 350022 Serjt. A. Hamilton (Cheetham).
No. 7301 Pte. D. S. Harris (Kennington Park).
No. 66541 Pte. T. Harris (Wadeford).
No. 31242 Pte. W. H. Harris (Lincoln).
No. 56708 Cpl. J. D. Hart (Stone).
No. 101193 Pte. J. W. Hickenbotham (Derby).
No. 352256 Cpl. L. Holland (Burnley).
No. 60316 Serjt. (Acting Staff-Serjt.) F. W. J. Hooper (Shrewsbury).
No. 369257 Pte. R. H. Hopkins (Newport, Mon.).
No. 40036 Serjt. W. H. Horn (Wimbledon).
No. 305016 Serjt. M. Hunter (Dundee).
No. 22712 Staff-Serjt. W. Hutchinson (Larne).
No. 450147 Pte. S. A. Jenkinson (Manchester).
No. 403490 Cpl. W. Jennings (Shipley).
No. 69457 Pte. J. Layton (Leeds).
No. 45908 Serjt. (Acting Staff-Serjt.) A. Linton (Lochgelly).
No. 45258 Pte. W. Loughton (Wheatley Hill).
No. 421252 Pte. J. Lowe (Wolverhampton).
No. 56870 Pte. A. Lutzes (Commercial Street, E.).
No. 358270 Pte. G. MacDonald (Burnley).
No. 90136 Serjt. J. McKenzie (Dundee).
No. 536047 Pte. F. C. Neale (Greenwich).
No. 19533 Cpl. (Acting Serjt.) E. P. Newman (Tottenham, N.).
No. 31862 Pte. P. J. O'Neill (Dublin).
No. 5695 Pte. (Acting Serjt.) F. Phillips (Taunton).
No. 46537 Pte. (Acting Cpl.) D. Pratt (Lochore, Fifeshire).
No. 55919 Pte. E. Price (Farnworth).
No. 36280 Pte. W. W. Richardson (Dumfries).
No. 417360 Pte. E. Roberts (Long Sutton).
No. 11902 Pte. T. Shenton (Hanley, Staffs).
No. 45646 Pte. (Acting Serjt.) W. W. Smith (Kineton).
No. 14764 Pte. (Acting Serjt.) T. C. Stanley (Failsworth).
No. 352171 Cpl. J. E. Street (Bradford).
No. 364395 Pte. A. Tanner (Coedkernen, Mon.).
No. 2142 Cpl. (Acting Serjt.) E. C. Taylor (Brixton).
No. 51002 Pte. E. Viggars (Stoke-on-Trent).
No. 73724 Pte. S. Walker (Northowram).
No. 554034 Pte. G. H. White (Canning Town).
No. 47632 Pte. H. E. Winter (Battersea).
No. 92581 Pte. B. Wright (Halifax).
No. 16820 Pte. W. Yea (Bournemouth).

War Office,
July 18, 1918.

With reference to the awards conferred as announced in the *London Gazette*, dated February 18, 1918, the following are the statements of service for which the decorations were conferred:—

Awarded the Second Bar to the Military Cross.

Temp. Capt. Archibald Fullerton, M.C., M.D., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked untiringly under heavy shell and machine-gun fire, attending to the wounded of his own and other units. His fearless conduct undoubtedly saved many lives.

Awarded a Bar to the Military Cross.

Temp. Capt. William Fotheringham, M.C., M.B., Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty. He attended to the wounded in an exposed position under heavy hostile gas shell fire. Though suffering badly from gas he continued at work with the greatest courage and determination until he was blinded by gas.

Temp. Capt. William John Knight, M.C., M.D., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked continuously during an engagement attending to the wounded under heavy fire, and later went into a village which was being heavily shelled, and brought away several wounded men. He went back to the front line after the position had been evacuated, and brought back several badly wounded men. He worked with untiring energy throughout the operations, and saved many lives.

Capt. Thomas Ainsworth Townsend, M.C., Royal Army Medical Corps.
For most conspicuous gallantry and devotion to duty. Although twice wounded he refused to have his wound attended to, and continued to dress the wounded under a continuous and heavy concentration of high-explosive and gas shells. Not only did he attend the wounded and gassed of his own unit, but rendered aid, under conditions of great difficulty, to wounded of neighbouring battalions, whose medical officers had become casualties. His complete disregard of personal danger and splendid devotion were a magnificent example to all.

Capt. Frederick William Lees, M.C., Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked untiringly attending to the wounded and superintending their evacuation. Though his aid post was continually under heavy shell fire he carried out his work with an energy and cheerfulness which were a splendid example to all. He saved many lives by his devotion to duty.

Awarded the Military Cross.

Temp. Capt. Eric Phillip Blashki, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He went forward during an engagement and established a dressing station in an advanced position. He remained at his post under

heavy shelling and collected the wounded from an area swept by machine-gun fire. He showed the greatest courage and resource.

Capt. Frank Chadwick, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. After the troops had been withdrawn he remained with the wounded all night in an advanced position, and organized their removal in the face of great difficulties. By his courage and determination he succeeded in getting all the wounded away.

Temp. Capt. Thomas Maitland Crawford, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He was wounded and rendered temporarily unconscious by a shell which mortally wounded the colonel and adjutant of his battalion. As soon as he recovered he attended to their wounded, and remained on the spot without having his own wounds dressed until stretcher-bearers arrived. He reported to brigade headquaaters before having his wounds attended to, and showed splendid courage and self-sacrifice.

Temp. Capt. William Claughton Douglas, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. While returning from the regimental aid posts he came under a heavy barrage, and was slightly wounded. Seeing that some men further back had been wounded he at once went to their assistance, got them under the only available cover, attended to their wounds, and organized stretcher parties for their removal. His prompt and gallant action saved the lives of two seriously wounded men.

Temp. Lieut. Frederick Barnes Elwood, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked with the greatest coolness and energy throughout two days' operations, attending to the wounded in his aid post close to the firing line. Later, he went out with his stretcher-bearers, and brought back many wounded who were lying out in "No Man's Land."

Capt. Archibald McLaren Ferris, M.B., Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty. He continually exposed himself to heavy fire in attending to the wounded during an attack. Later, when an officer was wounded and was lying out in an exposed position, he crawled out and brought him in over ground swept by the enemy's fire. His gallantry and courage undoubtedly saved many lives.

4th Class Assistant Surg. James Garnett Goodman, I.S.M.D.
For conspicuous gallantry and devotion to duty. He remained tending the wounded under heavy fire, until every case had been evacuated, after which he followed the battery into action. On the previous day seeing the battery come under an intense shell fire he at once went up to the guns to render assistance. His coolness, initiative and keenness were most marked.

Temp. Capt. James Huntley Legge, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in an enemy counter-attack which almost succeeded in penetrating to his aid post. With the greatest coolness and courage he continued his work of clearing the wounded, not only of his own battalion, but of other units. Throughout the hostile fire was intense, and it was due to his untiring efforts that so many wounded were quickly and efficiently evacuated.

Capt. Reginald Devereux Moore, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked continuously for eight days attending to the wounded at an advanced dressing station often under shell fire. His organization of the work was excellent, and by his courage and cheerfulness he inspired all ranks with confidence which assisted them materially in the performance of their duties.

Capt. John Gilbert Morgan, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. When the advanced dressing station had been ordered to withdraw he went forward with a party of bearers and successfully cleared a number of wounded from the regimental aid posts. The operation was carried out under continuous shell and machine-gun fire.

Temp. Capt. John Oscar Thomas, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He dressed a wounded officer and men under heavy fire and got them to a place of safety. He showed great coolness and courage.

Temp. Capt. Philip Hewer Wells, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He attended to the wounded of several units who were lying in an exposed position under fire. He worked throughout the night, often under an intense bombardment of gas and H. E. shells, and by his courage and self-sacrifice saved many lives.

Temp. Capt. Ernest William Gilmore Young, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He collected and dressed the wounded in an exposed position under heavy fire, and remained on the spot after the withdrawal of the regiment until all the wounded had been brought in.

Capt. Gavin Young, M.B., Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty in attending to the wounded under heavy machine-gun fire. He worked up to the leading wave and searched the whole ground for wounded

under continuous fire, and, owing to his exertions, all the wounded were evacuated with great rapidity. Later he showed great courage and devotion to duty in rescuing wounded from destroyed dug-outs under shell fire.

Capt. George May Foster, Army Medical Corps.

For conspicuous gallantry and devotion to duty. He was in charge of the evacuation of the wounded from the front line during the operations, and set a splendid example to his stretcher-bearers by his courage and determination. He led a party to remove several stretcher cases under heavy shell fire, and though wounded himself he attended to their wounds and arranged for their removal.

Capt. Alfred Stannage Porter, Army Medical Corps.

For conspicuous gallantry and devotion to duty. He dressed many wounded during the operations, working in the open under intense fire, and set a splendid example of courage and self-sacrifice.

CHANCERY OF THE ORDER OF SAINT MICHAEL AND SAINT GEORGE.

Downing Street,
July 27, 1918.

The King has been graciously pleased to give directions for the following appointments to the Most Distinguished Order of Saint Michael and Saint George, for services rendered in connexion with Military Operations in East Africa. Dated June 3, 1918:—

To be additional members of the Third Class, or Companions, of the said Most Distinguished Order:—

Col. Gerard William Tate, D.S.O., M.B., Army Medical Service.

Lieut.-Col. Reginald George Turner, D.S.O., F.R.C.S., Indian Medical Service.

War Office,
July 27, 1918.

His Majesty the King has been graciously pleased to approve of the undermentioned Rewards for Distinguished Service in connexion with Military Operations in East Africa. Dated June 3, 1918:—

TO BE BREVET LIEUTENANT-COLONEL.

(On Retired List, Reserve of Officers, Special Reserve, New Army, of Territorial Force, in the case of officers belonging to these categories, as applicable.)

Major (Temp. Lieut.-Col.) W. Benson, D.S.O., M.B., Royal Army Medical Corps.

AWARDED A BAR TO THE DISTINGUISHED SERVICE ORDER.

AWARDED THE DISTINGUISHED SERVICE ORDER.

Lieut.-Col. Arthur Charles Adderley, Royal Army Medical Corps.

Temp. Major (Acting Lieut.-Col.) Thomas Malcolm Russell Leonard, Special List, West African Medical Service, West African Field Force.

South African Forces.

Capt. (Acting Major) Alexander McWatt Green, South African Medical Corps.

Lieut.-Col. Temple Smyth, South African Medical Corps.

AWARDED THE MILITARY CROSS.

Capt. Frank Montague Barnes, M.R.C.S., L.R.C.P., Royal Army Medical Corps (Special Reserve).

Capt. Henry Drummond Brown, M.B., Royal Army Medical Corps (Special Reserve).

Lieut. Norman Stewart Bruce, Royal Army Medical Corps (Special Reserve).

Temp. Lieut. Gilbert Burnet, M.B., Royal Army Medical Corps.

Capt. Harold Armstrong Crouch, M.R.C.S., L.R.C.P., Royal Army Medical Corps (Special Reserve).

Temp. Capt. Mark Clayson Gardner, M.B., Royal Army Medical Corps.

Temp. Capt. Ernest Gibson, Special List, West African Medical Service, attd. Nigeria Rifles, West African Field Force.

Capt. James Burne Papsley, M.B., F.R.C.P., Indian Medical Service, attd. C.F.A.

Capt. George Smith Lawrence, M.B., Royal Army Medical Corps (Special Reserve).

Temp. Capt. Thomas Hunter Massey, East African Medical Service, attd. King's African Rifles.

Temp. Capt. Henry Ruddock Morehead, Special List, West African Medical Service, attd. Nigeria Rifles, West African Field Force.

Temp. Capt. Thomas Robert Sandeman, M.B., F.R.C.S., Special List, West African Medical Service, attd. Nigeria Rifles, West African Field Force.

Capt. Ralph Roylance Scott, Royal Army Medical Corps (Special Reserve).

Temp. Capt. Christopher James Wilson, East African Medical Service, attd. King's African Rifles.

Temp. Capt. William Hall Watson, South African Medical Corps.

War Office,
July 25, 1918.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for distinguished services rendered during the course of the campaign.

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

DECORATION CONFERRED BY HIS MAJESTY THE KING OF THE BELGIANS.

Ordre de la Couronne.

Chevalier.

Temp. Capt. Adrian Stokes, D.S.O., M.D., F.R.C.S.I., Royal Army Medical Corps.

ROYAL ARMY MEDICAL CORPS PRISONERS OF WAR FUND.

(OFFICIAL CARE COMMITTEE RECOGNIZED BY THE WAR OFFICE FOR THE ROYAL ARMY MEDICAL CORPS.)

THE following is the third list of contributions by units at home and abroad to our Prisoners of War Fund, and the Hon. Secretary begs to express his regret at the delay in issuing it. The list only contains the amounts received up to the middle of May, and it is hoped that a further instalment may be published at an early date.

The number of subscribers and the work connected with the Fund has greatly increased in the last few months owing to the large increase in the number of our prisoners. All the contributors may rest assured that, thanks to the Ladies' Committee, the supply of parcels has never run short, and they are distributed with the greatest regularity to the men in captivity, principally in Germany.

The price of parcels has, like all other commodities, considerably increased, and each cost 10s., so it is hoped that the generous donations of units and other friends may be maintained at their present satisfactory level.

LIST OF COMPANIES AND UNITS AT HOME AND ABROAD.

CONTRIBUTIONS TO PRISONERS OF WAR FUND IN 1918.

	£	s.	d.
May 1.			
No. 6 Sanitary Section	£1	15	2.
Advance Depot Medical Stores, No. 12	1	5	9
2/3rd City of London Field Ambulance	5	2	8
8th Training Battalion, Blackpool	5	0	0
133rd Field Ambulance	9	4	2
35th Company R.A.M.C., Millbank	10	0	0
100th Field Ambulance (4 cheques)	15	12	6
No. 2 Casualty Clearing Station	12	0	0
30th Motor Ambulance Convoy	11	0	0
38th Casualty Clearing Station ..	33	9	2
112th Field Ambulance	14	13	4
107th Field Ambulance	2	0	0
76th Field Ambulance	15	0	0
9th General Hospital ..500 fr.			
74th Field Ambulance	5	17	8
No. 1 Casualty Clearing Station	15	0	0
46th Field Ambulance	10	13	1
No. 39 Casualty Clearing Station	6	0	0
72nd Field Ambulance ..600 fr.			
73rd Field Ambulance ..190 fr.	7	0	0
Stationary Hospital, Abancourt	8	9	0
106th Field Ambulance	5	0	0
7th Training Battalion, Blackpool	9	18	8
7th Stationary Hospital ..	6	0	0
7th Casualty Clearing Station ..	£22	0	0
10th Casualty Clearing Station	25	13	9
17th Casualty Clearing Station	10	0	0
Queen Mary's Hospital, Whalley	50	0	0
62nd General Hospital	31	14	7
96th Field Ambulance	9	13	6
24th Field Ambulance	40	0	9
3/2nd Lancs. Field Ambulance..	16	10	0
15th Casualty Clearing Station	2	7	8
No. 19th Company, Chester ..	30	0	0
3rd Cavalry Field Ambulance ..	25	0	0
99th Field Ambulance	10	0	0
23rd Casualty Clearing Station	50	0	0
Military Convalescent Hospital, Holywood	8	0	0
H Company Territorial Force Depot, Blackpool	34	10	0
7th Company R.A.M.C., Devonport	30	0	0
6th General Hospital (Officers' Mess)	5	0	0
No. 11 General Hospital, A Section	14	0	0
15th Motor Ambulance Convoy (Concert)	30	0	0
60th Field Ambulance	7	15	0
No. 83 General Hospital ..	12	0	0
No. 50 General Hospital ..	20	0	0

R.A.M.C. Detachment, Cairo ..	£7	0	0
No. 7 Field Ambulance.. ..	5	0	0
No. 21 Casualty Clearing Station	10	0	0
34th Field Ambulance Officers, N.C.O.'s and Men	20	6	8
R.A.M.C., Netley	25	0	0
39th Ambulance Train	5	15	2
R.A.M.C., Dieppe and Le Treport	96	14	0
R.A.M.C., Dieppe and Le Treport .. .. (7113·75 fr.)			
No. 4 General Hospital.. ..	15	0	0
44th Casualty Clearing Station..	7	4	10
3rd North Midland Field Ambulance	2	10	0
Detachment R.A.M.C., Admiralty Pier, Dover	20	0	0
2/2nd North Midland Field Ambulance	24	4	6
O.C. Detachment, R.A.M.C. and Nursing Staff, Wareham ..	3	5	6
Detachment R. A. M. C. Rest Camp, Southampton	4	10	0
No. 2 General Hospital, France	19	11	9
111th Field Ambulance (Officers)	7	0	0
Military Hospital, Tidworth (Officers)	25	0	0
17th Advance Depot Army Medical Stores	1	0	0
No. 1 Field Ambulance	10	0	0
28th Company R.A.M.C., Gibraltar	4	4	0
42nd Stationary Hospital ..	9	11	3
42nd Stationary Hospital, Serjeants' Mess	3	0	6
54th Field Ambulance (Officers)	8	0	0

36th Field Ambulance	£30	0	0
74th General Hospital Officers' and Serjeants' Mess	29	0	0
Malta Serjeants' Mess, Cottonera	0	15	0
Malta Detachment R.A.M.C. ..	1	1	0
2/3rd South Midland Field Ambulance	2	2	0
50th Stationary Hospital, Colchester	1	2	6
Detachment R.A.M.C. Bovington Camp and 18th Battalion Tank Corps	10	16	0
113th Field Ambulance	6	18	0
Officers' Mess, R.A.M.C., Cosham	5	5	0
142nd Field Ambulance	18	0	0
11th Sanitary Section and Sanitary Squads	3	7	6
141st Field Ambulance	3	13	4
11th General Hospital, I.E.F. ..	12	5	0
37th Motor Ambulance Convoy..	17	7	0
1st Western General Hospital, T.F.	54	0	9
Valletta Military Hospital, Malta	6	0	0
Cape Coloured Labour Battalion Hospital..	2	12	0
14 Medical Officers of No. 8 General Hospital	14	0	0
64th Field Ambulance (Officers)	5	0	0
57th Casualty Clearing Station..	13	18	8
75th General Hospital	1	12	0
75th General Hospital .. 486 fr.			
A.D.M.S., —th Division ..	6	9	4
Fort Manoel Military Hospital, Malta	23	13	0
23rd Field Ambulance	22	0	0

BIRTH.

CHOPPING.—On August 4, at 1, Devonshire Gardens, Glasgow, the wife of Lieut.-Colonel A. Chopping, C.M.G., R.A.M.C., a daughter.

EXCHANGES, &c.

The charge for inserting Notices respecting Exchanges in the Royal Army Medical Corps is 5/- for not more than five lines, which should be forwarded by Cheque or P.O.O., with the notice, to Messrs. G. STREET and CO., Ltd., 8, Serle Street, London, W.C., not later than the 22nd of the month.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are inserted free of charge to subscribers and members of the Corps. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "Journal of the Royal Army Medical Corps," 324, Adastral House, Victoria Embankment, E.C. 4.

Communications have been received from Col. R. H. Firth; Major R. C. Wilmot; Capts. J. T. Grant, C. M. Finny, C. T. W. Hirsch, J. J. Healy; A. Bacot, Esq.

The following publications have been received:—

British: The Medical Press and Circular, The Hospital, The Practitioner, St. Bartholomew's Hospital Journal, The Royal Engineers' Journal, Bulletin of the Canadian Army Medical Corps, Veterinary Review, The Indian Journal of Medical Research, Agricultural Research Institute (Pusa), Guy's Hospital Gazette, The Indian Medical Gazette, The Medical Journal of Australia, The Medical Journal of South Africa, The Journal of Tropical Medicine and Hygiene, The British Journal of Surgery, The Journal of State Medicine, Butterworth's Medical Catalogue, 1918, *Edinburgh Medical Journal.*

Foreign: Bulletin de l'Institut Pasteur, The Military Surgeon, War Medicine, Surgery and Hygiene, L'Ospedale Maggiore, Archives Médicales Belges, Annali di Medicina Navale e Coloniale, Revista de Veterinaria e Zootechnia.

A free issue of twenty-five reprints will be made to contributors of Original Communications, and of twenty-five excerpts of Lectures, Travels and Proceedings of the United Services Medical Society.

Any demand for reprints, additional to the above, or for excerpts, must be forwarded at the time of submission of the article for publication, and will be charged for at the following rates, and additional copies at proportionate rates:—

Number of Reprints	Number of Pages	Cost of Reprints	Cost of EXCERPTS*	Extra for Covers for Reprints: As Journal, Printed on Front	As Journal, Plain, Unprinted	Cheaper Paper, Printed on Front	Cheaper Paper, Plain, Unprinted
		£ s. d.	£ s. d.	s. d.	s. d.	s. d.	s. d.
12	4	0 2 9	0 1 2				
	8	0 5 0	0 2 3	4 3	1 1	3 10	0 9
	16	0 8 3	0 3 11				
25	4	0 3 4	0 1 5				
	8	0 6 0	0 2 9	4 10	1 6	4 4	0 11
	16	0 10 6	0 5 0				
50	4	0 4 6	0 1 10				
	8	0 7 6	0 3 6	6 0	2 1	4 10	1 2
	16	0 13 3	0 5 10				
100	4	0 6 0	0 3 1				
	8	0 10 0	0 4 10	7 10	3 11	6 7	2 5
	16	0 18 6	0 7 6				
200	4	0 9 6	0 4 5				
	8	0 15 0	0 6 7	10 10	7 6	9 0	4 10
	16	1 6 0	0 9 8				

* These are not arranged as Reprints, but appear precisely as in the Journal with any other matter that may happen to appear on the first and last pages of the particular excerpt ordered.

MANAGER'S NOTICES.

The JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is published monthly, six months constituting one volume, a volume commencing on 1st July and 1st January of each year.

The Annual Subscription is £1 (which includes postage), and should commence either on 1st July or 1st January; but if a subscriber wishes to commence at any other month he may do so by paying for the odd months between 1st July and 1st January at the rate of 1s. 8d. (one shilling and eightpence) per copy. (All subscriptions are payable in advance.)

Single copies can be obtained at the rate of 2s. per copy.

The Corps News is also issued separately from the Journal, and can be subscribed for at the rate of 2s. (two shillings) per annum, including postage. Subscriptions should commence from 1st July each year; but if intending subscribers wish to commence from any other month, they may do so by paying for the odd months at the rate of 2d. per copy. (All subscriptions are payable in advance.)

Officers of the Royal Army Medical Corps possessing Diplomas in Public Health, etc., are kindly requested to register their special qualifications at the War Office. Letters of complaint are frequently received from officers stating that their special qualifications have not been shown in the Distribution List which is published as a supplement to the Journal in April and October of each year. As, however, the particulars of this list are supplied from official sources, officers are reminded that unless the possession of Diplomas, etc., has been registered at the War Office, no entry of such qualifications can be recorded in the Distribution List.

Letters notifying change of address should be sent to the Hon. Manager, "Journal of the Royal Army Medical Corps," 25, Adastral House, Victoria Embankment, E.C. 4, and must reach there not later than the 20th of each month for the alteration to be made for the following month's issue.

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JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

SEPTEMBER, 1918.

EXTRACT FROM THE "LONDON GAZETTE."

War Office.
July 26, 1918.

His Majesty the King has been graciously pleased to approve of the following awards to the undermentioned Officers, in recognition of their gallantry and devotion to duty in the Field:—

AWARDED A BAR TO THE DISTINGUISHED SERVICE ORDER.

Capt. (Acting Lieut.-Col.) Francis Casement, D.S.O., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty when he evacuated all the wounded and salved a large quantity of surgical material, blankets and stretchers during a long retirement. His courage, coolness and resource were most marked during the whole of this trying period. (D.S.O. gazetted June 4, 1917.)

Major (Temp. Lieut.-Col.) Hugh Allan Davidson, D.S.O., M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. When in command of his unit he maintained the advanced dressing station in spite of heavy shelling by the enemy, only withdrawing when ordered to do so. He visited the regimental aid posts under heavy shelling, and by his example and energy many casualties were evacuated which might otherwise have been lost. (D.S.O. gazetted January 1, 1917.)

Capt. (Acting Lieut.-Col.) Thomas Swan Eves, D.S.O., M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He was in charge of an advanced dressing station which was being heavily shelled by the enemy, and he personally and thoroughly carried out a complete change of organization. Later, he was superintending the loading of ambulance cars near a railway bridge which was a special target for the enemy's guns, and though twice thrown over and bruised by bursting shells he stuck to his post till all the wounded had been dressed and evacuated. His fine performance under continuous shell fire till the enemy were close upon him was a splendid example to all. (D.S.O. gazetted January 1, 1918.)

Lieut.-Col. Fitzgerald Gabbett Fitzgerald, D.S.O., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. When his casualtry clearing station was heavily shelled he not only evacuated his patients to places of safety, but salved practically all the stores of his unit. This action was performed twice over, and on both occasions his courage and ability were prominent. (D.S.O. gazetted January 1, 1917.)

Major (Temp. Lieut.-Col.) Harry Beatty Kelly, D.S.O., M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. When the camp, in which over forty stretcher cases were collected, was heavily shelled, he collected the bearers and removed the wounded to a position of safety. Again, when the infantry were being withdrawn, he collected casualties with the bearers and carried them through a heavy barrage to the ambulance cars, thus saving several lives and setting a fine example to his men. (D.S.O. gazetted January 1, 1917.)

Lieut.-Col. John Powell, D.S.O., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during a long period of active operations. Owing to the great number of extemporized formations from the divisions, which increased continually from day to day, the task of providing adequate medical facilities was one of extreme difficulty. By his indefatigable energy and powers of organization he successfully met all demands, and completed the evacuation of all wounded with splendid efficiency. On one occasion, hearing some wounded had been left behind, he went himself, under heavy and continual shell and machine-gun fire, with three ambulances, and brought them in. Throughout, his conduct was beyond all praise. (D.S.O. gazetted June 3, 1918.)

Temp. Capt. (Acting Lieut.-Col.) Lawrence Drew Shaw, D.S.O., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He was placed in charge of the forward division of the combined field ambulances. Although constantly exposed to heavy shell and machine-gun fire, he organized the system of evacuation and extended it to neighbouring divisional units. By his inspiring example and disregard of danger he ensured a complete and successful evacuation of the wounded. (D.S.O. gazetted June 4, 1917.)

Capt. (Acting Lieut.-Col.) William Tyrrell, D.S.O., M.C., M.B., Royal Army Medical Corps (Special Reserve).

For conspicuous gallantry and devotion to duty when in charge of a line of evacution. He worked continuously for six days, and it was due to his gallantry, organization and energy that touch was maintained so efficiently with the brigades, and so many casualties evacuated. He displayed great courage and coolness throughout, and inspired those under him by his fine example. (D.S.O. gazetted January 1, 1918.)

AWARDED THE DISTINGUISHED SERVICE ORDER.

Temp. Capt. (Acting Lieut.-Col.) Kenneth William MacKenzie, M.C., M.B., Royal Army Medical Corps (late Capt. Indian Medical Service).

For conspicuous gallantry and devotion to duty when in charge of the forward evacuation, when he kept in touch with the retiring infantry, continually searching for and collecting the wounded. It was largely due to his great energy, skill and foresight that so many of our casualties were so successfully evacuated.

Capt. (Acting Lieut.-Col.) Arthur Thomas Pitts, Royal Army Medical Corps (Special Reserve).

For conspicuous gallantry and devotion to duty. He established a dressing station in a forward and very exposed position. During two days and two nights he remained under continuous and terrific shell fire, dressing wounded and evacuating them. His courage and endurance under most trying conditions saved many valuable lives.

Capt. (Acting Lieut.-Col.) Leopold Thomas Poole, M.C., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during a hostile attack. Hearing that a large number of wounded were uncollected owing to normal communications having been cut by the attack, he proceeded at once to the area, which was subjected to a sustained bombardment, and organized stretcher parties, sending up all his available cars. It was owing to his fine courage and promptitude that upwards of 300 casualties were not left unattended.

Temp. Capt. Frederick Naylor Stewart, M.C., M.D., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He collected and dressed cases under the most intense shell fire, and on two occasions, by remaining behind after the order to withdraw had been given, succeeded in evacuating all the stretcher cases. He set a high example of courage and self-sacrifice. He was wounded in the face and thigh.

Temp. Capt. James Lennox Stewart, M.C., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. Although his aid post was in the open, a few yards behind the front line, he remained there, caring for the wounded, and through his efforts they were all dressed and evacuated. He was the only medical officer of the Brigade left.

Capt. (Acting-Lieut.-Col.) Charles Herbert Stringer, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty when in charge of an advanced dressing station. Owing to the whole force retiring, the collection and evacuation of large numbers of wounded, who were lying in thick woods, was a task of extreme difficulty in view of the rapid advance of the enemy. Although subjected to heavy fire, he remained behind till the enemy were almost up to his position, and by skilful organization he succeeded in evacuating practically all the wounded. His magnificent courage and devotion saved many wounded from falling into the enemy's hands.

Capt. (Acting Lieut.-Col.) Joseph Hugh Ward, M.C., M.B., Royal Army Medical Corps (Special Reserve).

For conspicuous gallantry and devotion to duty while in command of a cavalry field ambulance During two days of intense fighting, in spite of the enforced moves of his unit, he continued to keep an A.D.S. open until the last possible moment to deal with large numbers of wounded, only

retiring when all had been evacuated and when ordered to do so. Throughout this period he showed an example of pluck and determination beyond all praise.

Temp. Capt. Roger Llewellyn Williams, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during operations, when, with the C.O. and adjutant, he was the last to withdraw. Shortly after, the C.O. was severely wounded, but, with the assistance of another officer, he carried him away for over half a mile under intense machine-gun and rifle fire at close range. Afterwards he continued to dress the wounded, including the adjutant, under the most intense fire, and throughout the withdrawal he showed the utmost energy and devotion to duty.

Temp. Capt. (Acting Major) Herbert George Willis, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. When in command of a bearer division of the field ambulance throughout ten days' fighting, he kept all in order by visiting the R.A.P.s and ambulance relay posts, and when the trolley line was destroyed by shell fire he reorganized the system of evacuation, going round the posts and making the necessary arrangements at great personal risk. By his action he ensured the clearance of the wounded.

Australian Imperial Force.

Major Archibald John Collins, M.C., Australian Army Medical Corps.

For conspicuous gallantry and devotion to duty when in charge of the evacuation of wounded during intense fighting. Although the A.D.S. in which he was located was subjected to heavy enemy artillery fire, by his splendid energy, coolness and courage, he was enabled to evacuate safely several hundred casualties. His magnificent example inspired all who came in contact with him, and stimulated junior officers and exhausted stretcher-bearers to further efforts.

Awarded a Second Bar to the Military Cross.

Temp. Capt. (Acting Major) Charles Bromley Davies, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty while in charge of an advanced dressing station. His energy throughout whilst supervising the collection of the wounded was remarkable, and it was due to him that the collection and evacuation of the wounded was so quickly and thoroughly carried out. Though slightly wounded he remained at duty for another eight days, when he was severely wounded. His courage and energy were of a very high order. (M.C. gazetted August 25, 1916.) (Bar to M.C. gazetted July 18, 1917.)

Temp. Capt. James Wallace MacFarlane, M.C., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty in going under heavy shell fire to the assistance of a wounded man who was lying in the shelled area, dressing his wounds, and getting him safely to cover. He without doubt saved the man's life. (M.C. gazetted July 26, 1917.) (1st Bar gazetted February 4, 1918.)

Awarded a Bar to the Military Cross.

Temp. Capt. Phillipe Bernard Belanger, M.C., M.D., Royal Army Medical Corps.

For gallantry and devotion to duty when the enemy had penetrated the defences on the left of his battalion in support, and were outflanking battalion headquarters. He went across 300 yards of ground swept by severe machine-gun and rifle fire to assist a wounded officer, and had him carried into safety. He displayed great courage and self-sacrifice throughout operations. (M.C. gazetted October 18, 1917.)

Captain (Acting Major) Henry Bryan Frost Dixon, M.C., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. This officer remained behind in "No Man's Land" and dressed three officers under extremely heavy machine-gun fire, and helped to carry a wounded man more than two miles to a place of safety. Later, he continued to dress all wounded although practically surrounded by the enemy. His cheerfulness and disregard of personal danger under these exceptionally trying circumstances, inspired all ranks. (M.C. gazetted November 14, 1916.)

Capt. Walter Elliot Elliot, M.C., M.B., Royal Army Medical Corps (Special Reserve).

For conspicuous gallantry and devotion to duty. He established a regimental aid post and for twelve hours, assisted by two officers, and in spite of continuous shelling, attended to over 250 wounded and succeeded in evacuating all to the dressing station. It was due to his personal courage and example that this was successfully carrried out. (M.C. gazetted June 18, 1917.)

Capt. (Temp. Major) James Douglas Fiddes, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. In charge of an advanced field dressing station which was heavily shelled, he successfully evacuated all the wounded to a safer place. He also went up to the front when the officer in charge there was exhausted and gassed, and superintended the evacuation of all the wounded. (M.C. gazetted February 4, 1918.)

Temp. Capt. James Phillips Jones, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He was in charge of an advanced dressing station, and when the village had been temporarily evacuated he was entirely responsible for the

getting away safely of many of the wounded. Throughout the ten days of the battle he displayed the most conspicuous ability, cool courage and devotion to duty. (M.C. gazetted February 4, 1918.)

Temp. Capt. Ronald Sinclaire Kennedy, M.C., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. When in charge of advanced bearers he collected and led forward reinforcing bearer-squads in a most gallant manner through a heavy barrrage and through lines of retiring infantry, until he gained touch with the regimental aid post. He cleared many wounded who would otherwise have been left to the enemy. A splendid example of persevering gallantry and fearlessness. (M.C. gazetted September 26, 1917.)

Temp. Capt. (Acting Major) John Samuel Levis, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty when in charge of stretcher-bearers at the advanced dressing station, his courage and example in leading squads over heavily shelled ground were the means of saving many lives. When ordered to evacuate, he displayed great ingenuity and resource in saving his personnel and equipment. Throughout the operations he has rendered most valuable services. (M.C. gazetted January 26, 1917.)

Temp. Capt. James Manuel, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty whilst battalion medical officer. During a withdrawal he frequently dropped back unaccompanied by medical staff and under very heavy fire attended to casualties. His conduct throughout the operations was of a high order. (M.C. gazetted February 4, 1918.)

Temp. Capt. John Hay Moir, M.C., M.D., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. During a withdrawal he repeatedly went into the open under heavy fire, to attend to the wounded. Throughout the withdrawal seven officers of the battalion were wounded. That only one was left in the hands of the enemy was largely due to the magnificent courage which he displayed. (M.C. gazetted November 14, 1916.)

Temp. Capt. George Rankine, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during a withdrawal. He superintended the evacuation of wounded without rest and at great personal risk, notably when the left flank became exposed, and he led the bearers with great courage near the railway embankment and evacuated all the wounded under heavy artillery and machine-gun fire. (M.C. gazetted November 4, 1915.)

Temp. Capt. Charles Roche, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty in evacuating wounded from the front line to the advanced dressing station. Four out of the five collecting posts occupied by him were heavily shelled, but he continued to work incessantly, and evacuated a large number of wounded. M.C. gazetted October 20, 1916.)

Capt. Thomas Victor Somerville, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. When his battalion was about to withdraw and the wounded could not be brought to his aid post in time, he went up to the firing line and stayed there attending to the wounded till all the troops had withdrawn. His gallant conduct saved many lives. (M.C. gazetted January 14, 1916.)

Capt. (Acting Major) John Stephenson, M.C., Royal Army Medical Corps (Special Reserve).

For conspicuous gallantry and devotion to duty in continuing to dress cases in the open under heavy shell fire. When the advanced dressing station was heavily gas shelled and several casualties he saved many of the patients and staff from being gassed by his example and coolness. On one occasion he went through a heavy barrage to the regimental aid post and by his coolness and judgment all ranks were encouraged to persevere in clearing the wounded. (M.C. gazetted September 26, 1917.)

Temp. Capt. Charles Gordon Timms, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during recent operations. He continued to collect and evacuate wounded from his post, though several times nearly surrounded by the enemy and under heavy sdell fire. By his fine courage and self-sacrifice he was able to get away a large number of wounded under most difficult conditions. (M.C. gazetted July 18, 1917.)

Temp. Capt. John Wilfred Watthews, M.C., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during the evacuation of a line. He displayed the utmost courage and coolness in evacuating wounded under very heavy shell fire, and it was entirely owing to his energy and personal example that the whole of the wounded were got away in safety. Later, having lost the whole of his medical outfit, he rendered invaluable assistance in rallying the men in his vicinity. (M.C. gazetted November 26, 1917.)

Awarded the Military Cross.

Temp. Capt. Edward Arthur Aldridge, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty at the dressing station, remaining until the enemy were upon him and having cleared his aid post, working his way back, collecting the wounded and attending to them under heavy shell fire. His courage and self-sacrifice set a splendid example, and were worthy of the highest praise.

Temp. Capt. William Brodie Gurney Angus, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty during recent operations. He was the means of saving the lives of many officers and men, especially on one occasion when the brigade suffered severe casualties from shell fire. He was untiring in carrying out his duties and removing the wounded to a place of safety.

Capt. John Webster Archibald, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty during recent operations. The battery position of the brigade was subjected to an intense bombardment in connexion with the enemy attack, and although shell fire round his own headquarters was severe, he visited all the battery positions himself, instead of having the casualties brought to him. His complete disregard for personal safety in order to save the wounded being brought through the enemy barrage undoubtedly resulted in the saving of life and of many casualties. His courage and cheerfulness under a heavy and continuous strain was of the greatest value, and a fine example to all.

Qmr. and Hon. Capt. James Harvey Bounds, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He volunteered to take transport to an advanced dressing station for the purpose of removing valuable medical stores and equipment, and successfully carried this out, passing through a heavy barrage, and was the means of bringing away and saving two medical officers and twenty stretcher-bearers who had thought it too late to get away. His courage and resource were most marked.

Capt. (Acting Major) Charles Philip Brentnall, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty during two days at an advanced collecting post under conditions of great danger. Although heavily shelled he succeeded in keeping his post clear and getting away all the wounded. The collection and evacuation of wounded was rendered particularly difficult owing to the fact that the troops were executing a withdrawal.

Capt. Charles Herbert Budd, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in attending to wounded under fire. Under heavy shelling, he went forward and dressed wounded, and dressed one man under full observation of the enemy.

Temp. Capt. George Milne Cameron, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty when in charge of bearers. He worked incessantly for twelve hours collecting and evacuating the wounded under heavy shell and machine-gun fire. Many cases were successfully got away, which, but for his determination and absolute disregard of danger, would have fallen into the hands of the enemy.

Capt. David Campbell, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty, when on two occasions he was the only medical officer left with the brigade. He organized regimental aid posts and established lines of evacuation, and during a long exposure to shell and machine-gun fire set an inspiring example to all.

Temp. Capt. Dugald Stewart Campbell, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked without rest, and when it was necessary to retire successfully brought away all the wounded, in spite of the district being subjected to a heavy gas bombardment. He was undoubtedly the cause of saving the lives of many wounded.

Temp. Capt. Thomas Hay Campbell, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. When under heavy shell and machine-gun fire he organized a forward aid post and evacuated over 500 wounded. No wounded man was allowed to pass without personal attention, in spite of the difficulties of doing so in an exposed position.

Capt. Louis Abel Celestin, Royal Army Medical Corps.
For conspicuous gollantry and devotion to duty. He remained with a party which was covering the retirement, and attended to the wounded under heavy rifle and machine-gun fire. Later, he dressed a medical officer's wounds, and carried him single-handed for a distance of over half a mile through heavy fire, when the officer he was carrying died of wounds.

Temp. Capt. Richard Collier Coatsworth, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty during an enemy attack. He early led his regimental stretcher-bearers through very heavy shell fire to remove all wounded that could be found. He organized the removal of wounded, and by his perpetual cheerfulness and coolness set a fine example to his men, and effected the successful evacuation of many wounded.

Qmr. and Hon. Lieut. Henry Arthur Charles Cole, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty while in charge of the operations at the trains in which the casualty clearing station equipment was being loaded. For many hours the locality, and particularly the railway line, was being heavily shelled, but he voluntarily remained on duty for over twenty-four hours after a heavy day's previous work, and it was mainly owing to his splendid example that almost all the equipment was safely got away.

Temp. Capt. Alan Gibb Cook, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty while clearing wounded under heavy machine-gun and shell fire during an enemy attack. When the officer in charge of the bearers became a casualty, he carried on the evacuation of the wounded, though badly gassed himself. He frequently led squads to the front line in search of wounded, and showed great disregard of danger.

Temp. Capt. William Francis Cornwall, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. When the enemy carried out a heavy bombardment with large calibre shells and gas he established on his own initiative a dressing-station, and continued to deal with cases of various units for five hours, during which time the shelling was intense. To evacuate the wounded he organized stretcher parties of prisoners, no other means being at the time available.

Temp. Capt. James Robert Craig, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He kept in touch with the retiring troops, evacuating the wounded without relief for eight days and nights. While the advanced dressing-station was under heavy fire, and all the other officers had been either killed or wounded, he continued to carry on his work.

Temp. Lieut. Gwilym Charles Montague Davies, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. When a neighbouring village was being heavily shelled, he went there to see if he could help. Finding that the field ambulance had withdrawn, he re-opened the dressing station, and remained there for hours, managing to evacuate a large number of wounded.

Temp. Capt. Llywelyn ap Ivan Davies, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty when, all the Royal Army Medical Corps in an area having been taken by the enemy, he was sent up to establish a system of evacuation. In spite of heavy shelling, he kept his cars and bearers working for twenty-four hours, only retiring when the infantry passed him, and by so doing prevented many of the wounded from falling into the hands of the enemy.

Temp. Capt. Edward Forbes, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. While the battalion was preparing to march off, three officers and thirteen men were wounded; this officer attended to them all under heavy fire. Later he was wounded while attending to his duties.

Temp. Capt. (Acting Major) Charles Colder Forsyth, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. Hearing that help was urgently required at a certain point, he organized stretcher-bearers to clear away the wounded, of which there were over 200. He remained in the area, which was heavily shelled, during the whole afternoon and until all the wounded had been evacuated. His splendid courage and initiative in organizing this evacuation undoubtedly saved the lives of many of the wounded who would otherwise have perished.

Capt. Charles Wainwright Fort, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during several days, when acting as bearer officer. The conditions under which the wounded had to be collected and evacuated were particularly difficult owing to the fact that the troops were executing a withdrawal. By his total disregard of danger, and initiative in bringing forward his bearers, often under heavy shell fire, he succeeded in clearing large numbers of the wounded.

Capt. Frederick Gamm, M.B., Royal Army Medical Corps (Special Reserve).

For conspicuous gallantry and devotion to duty for several days when in charge of an advanced dressing station, and until it was almost surrounded by the enemy. During this time, although under a continuous and heavy bombardment, he continued to dress casualties and organize stretcher squads, which he took out to search for wounded. By his courageous action many wounded were collected and evacuated, and his splendid example was a fine stimulus to all.

Temp. Capt. David Gillespie, M.D., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. During recent operations he did most useful work in tending wounded and arranging for their removal under fire. The work was often done under heavy machine-gun fire at medium range. His coolness and fine example greatly contributed to successful evacuation being carried out.

Temp. Capt. Morley Edward Gorman, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty in carrying on his work when the dressing station was destroyed by shell fire, and in visiting his posts and superintending the evacuation of the wounded under heavy shell fire. Throughout the operations he displayed the utmost coolness and contempt of danger, his cheery optimism and energetic personal example inspired confidence in all.

Temp. Capt. (Acting Major) Howard Boyd Graham, D.S.O., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty while in charge of over 300 bearers, always under heavy shell fire and often under machine-gun fire at close range. It was due to his

judgment that the wounded were evacuated with a minimum possible loss in personnel. On one occasion, being cut off by the enemy, he led his party to safety by a wide detour. When his dressing-station was heavily shelled, with the infliction of heavy casualties, he organized the rescue work, rallied the shaken bearers, selected the line of evacuation, and, with the aid of another officer, evacuated fifty-four casualties to a place of safety. His conduct through this fiery ordeal was magnificent.

Temp. Capt. Edward William Dacre Hardy, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. His dressing-station was situated at cross-roads, the only place available, and during a whole day was obviously a target for exceptionally intense bombardment. He displayed the greatest courage and supreme contempt of danger, remaining at his post and dressing wounded the entire day while everybody else was dug in.

Temp. Capt. George Francis Palmer Heathcote, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty throughout many days of active operations. He was absolutely tireless in his work of rescuing and caring for the wounded, and freely exposed himself to heavy rifle and machine-gun fire in carrying out his duties. By his splendid courage and energy throughout the whole operations, he was instrumental in getting away most of the wounded.

Temp. Lieut. Robert John Helsby, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty when the battery area being heavily shelled he dressed the wounded with complete disregard of personal safety, and in spite of being blown up in a house and badly shaken.

Temp. Capt. Francis Henderson, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. Throughout ten days' fighting this officer set a splendid example. On one day for twelve consecutive hours he was engaged in leading squads of bearers to and from the regimental aid posts. He frequently dressed men in the open when their condition needed it. He brought a wounded officer back in a car, several times stopping it under heavy fire to make the officer more comfortable.

Capt. (Acting Major) Howard Henry, M.D., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty during several days when acting as bearer officer. The conditions under which the wounded had to be collected and evacuated were particularly difficult, owing to the fact that the troops were executing a withdrawal. By his total disregard of personal danger and coolness he set a brilliant example to the bearers under his command, and undoubtedly was the means of saving many lives.

Capt. Robert Alexander Hepple, Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty. The advanced dressing station was hit by three shells simultaneously, when the building was demolished and several men killed or wounded. He at once set to work to recover the wounded from under the debris and did not leave till all had been cleared, in spite of the continued intense shelling of the vicinity.

Temp. Capt. Stewart Hodgson, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty during recent operations. For a whole day, often under direct rifle and machine-gun fire, he attended the wounded and directed their evacuation. Although wounded, he continued his duties with exceptional coolness and skill until the advancing enemy compelled withdrawal.

Temp. Capt. Hugh Llewellyn Glyn Hughes, D.S.O., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked day and night in the open in spite of the heaviest shell and machine-gun fire, tending the wounded and helping them back to safety, with a spirit of cheerfulness and self-sacrifice rarely seen. After being wounded he still continued to perform his duties, until the wound necessitated his evacuation.

Temp. Capt. Thomas William Jackson, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty during an enemy attack. He was with two other medical officers in a dressing station when the troops in front fell back. The dressing station was full of wounded, and this officer continued with the two others to tend the wounded despite the close proximity of the enemy, till, thanks to a counter-attack by our troops, every case was cleared. This was a fine act of courage and devotion to duty.

Temp. Capt. George William Blomfield James, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty throughout a retirement in remaining behind with the rearguard, dressing and evacuating wounded under very heavy fire, until his medical stores were exhausted and he was in danger of being cut off. It was due to his tireless energy that so few wounded fell into the hands of the enemy. His resource and cheerfulness throughout were a real encouragement to all.

Capt. Arthur Morrell Johnson, M.D., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in tending and evacuating the wounded in the front line and under continual fire. When the order to withdraw was issued he remained till the last, and it was entirely due to his courage and energy that all the wounded were cleared.

Temp. Capt. Francis Esmond Keane, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. Throughout the operations he displayed the greatest courage and grit, working unceasingly without sleep, establishing aid posts, and evacuating wounded under heavy shell and machine-gun fire. His service to the battalion were most invaluable.

Temp. Capt. Richard Kenefick, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. While the regiment was consolidating its position, he attended to the wounded quite in the open and under very heavy fire, and arranged for their evacuation. He undoubtedly saved many lives which would otherwise have been lost. He was wounded in the foot, but did not relax his energy, and continued to attend to all the wounded in the vicinity.

Capt. Joseph Illingworth Lawson, Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty in bringing in wounded under heavy shell fire, with no one between him and the enemy, thereby saving them from being made prisoners.

Temp. Capt. George Austen Lilly, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. In order to attend the wounded he frequently crossed an exposed piece of ground 300 yards in length. Later, when the horses had to be moved owing to heavy shelling, he rescued a badly wounded man, carrying him to safety.

Capt. Henry Guy Ludolf, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. For six days he worked under continuous fire, and during the last two days was the only doctor on the spot attending to the wounded of five different battalions. He was himself suffering from a severe attack of neuritis, but stuck to his work till assistance came. During these six days his personal heroism and abnegation of self were beyond all praise, and owing to his gallant conduct the lives of many were saved.

Capt. John Alexander MacKenzie, M.B., Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty at an advanced dressing station, under heavy shell fire, during an enemy attack. He persisted in his work, and successfully evacuated all the wounded before withdrawing his personnel. At another advanced dressing station later he stuck to his duty for seventy-two hours without rest.

Temp. Capt. Alan Cowan Mann, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. Throughout eight days' operations this officer did fine work in tending and clearing the wounded. On one occasion, when the line fell back, he remained with the wounded and succeeded in clearing all that could be found before he withdrew. The splendid work done by the stretcher-bearers was due to this officer's organization and leading.

Temp. Capt. Harry Godfrey Massy-Miles, Royal Army Medical Corps.
For conspicuous gallantry and devotion during several days of severe fighting, when he kept in close touch with the battalion, working unceasingly, without rest, during the whole period, dressing the wounded, including the French. He showed great initiative in establishing forward R.A.P.s, reconnoitring their sites beforehand under heavy hostile shell fire, thus greatly assisting the rapid evacuation of casualties. His courage and cheerfulness throughont a period of great strain were beyond praise.

Temp. Capt. William Graeme Denroche McCall, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty when at a forward collecting post. During an afternoon large numbers of wounded had to be dealt with, and the approaches to the station were subjected to intense shell and machine-gun fire. He maintained the position for many hours, dressing and evacuating all wounded, though later he was in imminent danger of being surrounded. When the post was quite untenable he successfully withdrew all personnel and stores. His gallantry under conditions of extreme danger saved many lives.

Temp. Capt. Roger McGarth, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty when in charge of the bearers of his field ambulance. During the enemy's advance and while exposed to heavy shell and machine-gun fire he organized his bearers and evacuated many wounded, who otherwise would have been captured. He set a fine example of energy and courage.

Temp. Capt. Alexander Church Brodie McMurtrie, M.D., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. On several occasions he brought in wounded himself under shell fire and by his disregard of danger set a fine example to those under him. Owing to his arrangements and untiring efforts many lives were saved.

Capt. Hamilton Stephen Morre, M.B., Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty in constantly leading stretcher parties through intense shell and machine-gun fire, in order to evacuate the wounded. On one occasion the whole party except himself became casualties. He dressed his men in the open, and invariably stayed till all had been got away. His cool and determined gallantry was a great inspiration to all the men working under him, and his efforts saved many wounded from being captured.

Capt. Frederick Cecil Nichols, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. When the front line was forced back he maintained his dressing station, in the newly-formed front line until he had attended to every case, in spite of a heavy bombardment. Throughout the four days' fighting he displayed untiring energy and great personal courage.

Temp. Capt. Alger Roy Oram, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. In recent operations this officer under very heavy shell fire continued to attend to the wounded and evacuate cases under the most adverse circumstances. On several occasions, by his fine example and personal courage he saved many wounded who otherwise would have fallen into the enemy's hands.

Temp. Capt. John Lindesay Pearce, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty while in charge of a bearer post. He repeatedly led squads of bearers to parts of the line where wounded were collected, and it was due to his fine example that so many wounded were saved during a period when communication with the front was extremely difficult. He showed courage under shell fire, and was indefatigable in his duties.

Capt. Allan Campbell Pearson, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty when acting as second in command of a casualty clearing station. On several occasions and on different days he superintended the evacuation of wounded under heavy shell fire, and also, with the greatest courage and ability supervised the salving of equipment during bombing and machine-gun fire from hostile aircraft.

Temp. Lieut. Roland Wilfred Pearson, M.D., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in the performance of his duties during lengthy operations. On one occasion two direct hits were obtained on his post, and a patient, who was being dressed, was killed. On another day he followed the battalion in a counter-attack, and rendered the most magnificent service to the wounded, under heavy machine-gun fire. By his courage, fine example, and great devotion he has at all times inspired his stretcher-bearers, and it was mainly due to him that so many of the wounded were got away by the bearers.

Temp. Capt. James Potter, Royal Army Medical Corps.
For conspicuous gallantry and devotion during lengthy operations, when he continuously attended the wounded under heavy shell, machine-gun and rifle-fire, maintaining his regimental aid post until the enemy had nearly reached it. His splendid example of courage and devotion to duty were beyond praise.

Capt. (Acting Major) William James Purves, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty at a main dressing station, when, by his courage, untiring energy, and grasp of the situation over 1,000 wounded were passed through the station without a hitch, and when, owing to continuous shelling, he had to retire, all cases were got safely away. This was especially difficult, as the troops were executing a withdrawal.

Capt. John Wootton Rammell, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in dressing the wounded and carrying out his duties under heavy rifle and machine-gun fire. Owing to his ceaseless endeavours and skill all the wounded were evacuated. All ranks speak with admiration of his courage and good work.

Temp. Capt. John King Rennie, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty when, an advanced dressing-station having retired, he organized another in a village, which he only left when the enemy entered it, working all the time under a heavy fire. Subsequently he again organized the evacuation of the wounded under difficult conditions and saved many from falling into the hands of the enemy.

Capt. Henry Whitteron Robinson, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. In spite of continuous shell fire, during which his aid post sustained two direct hits, this officer worked without ceasing, giving unremitting attention to the wounded and organizing bearer squads.

Qmr. and Hon. Lieut. John Robinson, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. On two occasions, when his unit had to be rapidly evacuated, he worked unceasingly, without rest or sleep. The success with which patients were removed to places of safety and valuable Government stores got away without loss was principally due to his energy and determination.

Capt. Peter John Ryan, M.D., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty during lengthy operations in charge of bearers and advanced dressing-stations. He organized the whole forward work, and it was due to his individual efforts and energy that so large a number of casualties were prevented from falling into hostile hands. He worked continuously throughout the whole retreat and his success was such that no wounded man fell into the enemy's hands after once having been put

under the care of the field ambulance bearers. His work was carried out under extremely difficult conditions and often under heavy shell fire. His devotion to duty was quite beyond praise.

Temp. Capt. Cuthbert Scales, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty when in charge of stretcher-bearers. He collected and evacuated many wounded under heavy fire, and remained at his post until forced by the advance of the enemy to withdraw his collecting post farther back. There he continued collecting and evacuating as long as possible, showing a fine example to his men.

Capt. Hubert Shield, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty at advanced dressing stations. Under heavy fire, he managed to save all wounded from falling into the hands of the enemy, and remained doing his duty till his stations were cleared. In one dressing station, which he alone ran for sixteen hours, he dressed and evacuated over 300 men.

Capt. Thomas Copeland Storey, M.B., Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty. After the withdrawal from a wood, he discovered that some of the wounded had been left behind. He went forward and spent an hour and a half in front of the line, searching the wood, and brought them all back, in spite of considerable hostile fire. Otherwise they would undoubtedly have fallen into the hands of the enemy.

Temp. Capt. Raymond Brewitt Taylor, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He searched for a missing stretcher-bearer for two hours under heavy shell fire, at last finding him in a shell-hole and assisting to carry him back. Throughout nine days' fighting he was constantly going forward, under fire, searching for and bringing in wounded.

Capt. William Walker, M.B., Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty. He proceeded to a village under heavy fire and succeeded in attending and evacuating several wounded. He only desisted when the enemy entered the village. Later, he succeeded in releasing a party of stretcher-bearers who had been cut off. Throughout the operations he has shown the utmost energy and courage.

Capt. Henry Ernest Bantry White, M.B., Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty during recent operations. He was medical officer attached to the battalion, and for eight days he worked continuously without rest and often without food, generally under heavy fire, attending to the wounded. His efforts were tireless, and his courage and devotion to duty were the means of saving many lives.

Temp. Capt. David Roberts Williams, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty while in charge of bearers in evacuating wounded. On one occasion going back and searching for wounded when, in spite of darkness, barbed wire and torn-up ground, he brought away two men from an abandoned aid post, carrying one on his back. On another occasion it was largely due to his determination and grit that a camp, which was being heavily shelled, was evacuated of all wounded, when he remained till the last and saw that all was clear.

Temp. Capt. Charles Edgar Wilson, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty, when during a rearguard action he worked untiringly in the interests of the wounded, who all were safely evacuated, in spite of having to pass over a long stretch of open ground exposed to fire. Through all this trying time he was cool and cheerful, showing a complete disregard of personal danger.

Capt. Henry Wilson, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. For five days, under all kinds of enemy fire, he showed an utter contempt of danger and disregard of self. His energy and splendid behaviour undoubtedly saved many lives, and through his powers of organization no wounded were left behind when the battalion was relieved from the line.

Australian Imperial Force.

Capt. Kenneth Arthur McLean, Australian Medical Corps.
For conspicuous gallantry and devotion to duty during a heavy attack. Under heavy fire, he personally conducted bearer squads, organized the forward work of evacuation, and exerted himself to the utmost in saving wounded. His fine example served to keep the men under him working at high pressure, and ensured the complete evacuation of the positions.

Capt. Charles Eric Watson, Australian Medical Corps.
For conspicuous gallantry and devotion to duty. Under very heavy artillery fire he continued to dress the wounded for two and a half hours. Though many of the bearers were killed and wounded, he stayed with the stretcher cases, and it was owing to his fine courage and energy that many of the wounded were saved.

SOUTH AFRICAN FORCE.

Capt. William Smith, South African Medical Corps.

For conspicuous gallantry and devotion to duty during active operations. He displayed great courage in carrying on his duties, after being blown up by a shell, which wounded him and killed two of his orderlies, and he remained at duty until the battalion was relieved.

ROYAL ARMY MEDICAL CORPS.

SUPPLEMENTARY ORDER.

TEMPORARY PROMOTIONS.

The following temporary promotions to complete War Establishment will take effect from March 16, 1918.

To be Temporary Serjeant-Majors.

510001 Qmr.-Serjt. A. G. Hyett (with seniority before 322107 Qmr.-Serjt. G. R. Kerr, as published in Corps Order No. 2, dated June 1, 1918).

44002 Qmr.-Serjt. H. E. Dugan (with seniority after 322107 Qmr.-Serjt. G. R. Kerr).

401012 Qmr.-Serjt. C. Barber and 508005 Qmr.-Serjt. G. T. Packham (with seniority after 90466 Qmr.-Serjt. G. R. Smith).

316203 Qmr.-Serjt. J. K. Taylor (with seniority after 90543 Qmr.-Serjt. G. J. Pittman).

303016 Qmr.-Serjt. C. C. Thom, and 92522 Qmr.-Serjt. H. Jagger (with seniority after 28548 Qmr.-Serjt. H. Moore).

93641 Qmr.-Serjt. W. Kilgour and 31901 Qmr.-Serjt. J. McCrone (with seniority after 93669 Qmr.-Serjt. W. Paul).

456003 Qmr.-Serjt. H. W. Barry (with seniority after 18415 Qmr.-Serjt. A. Bell).

120106 Qmr.-Serjt. W. Williamson and 120113 Qmr.-Serjt. A. M. Mowat (with seniority after 18337 Qmr.-Serjt. C. Leaker).

370041 Qmr.-Serjt. R. S. Marks (with seniority after 15483 Qmr.-Serjt. E. Sharp).

495252 Qmr.-Serjt. A. G. Knight (with seniority after 18222 Qmr.-Serjt. A. Dady).

386012 Qmr.-Serjt. J. Murray (with seniority after 89700 Qmr.-Serjt. E. J. Batchelor).

32013 Qmr.-Serjt. J. H. McCracken (with seniority after 318344 Qmr.-Serjt. J. Macfarlan).

308032 Qmr.-Serjt J. W. Jackson (with seniority after 508250 Qmr.-Serjt. W. J. Perch).

34120 Qmr.-Serjt. R. Hollingsworth (with seniority after 17358 Qmr.-Serjt. C. Ennor).

368006 Qmr.-Serjt. J. Bray (with seniority after 12709 Qmr.-Serjt. H. J. Ford).

463003 Qmr.-Serjt. L. Parkhouse (with seniority after 465010 Qmr.-Serjt. E. Pillar).

The following are in order of seniority after 12065 Qmr.-Serjt. A. A. E. McKnight:—

Quartermaster-Serjeants: 120001 E. J. Skidmore, 67713 J. A. H. Glover, 366016 C. B. Bright, 472052 C. Hinton, 444005 B. Rusling, 16301 E. A. Lane, 459207 W. E. Phillips, 533004 F. J. Shaw, 301004 A. Carson, 554036 F. G. Gibbs, 421002 A. K. Hutchinson, 423008 A. H. Collier, 473002 G. W. Lightfoot, 364008 J. E. Rees, 28658 E. J. Downes, 9822 J. Carley, 28269 A. Brookes, 481053 W. C. Hunt, 90489 H. A. B. Greenwood, 39116 E. Mitchell, 534002 J. Williams, 410015 J. T. Meadley, 419477 W. C. Williams, 435017 A. H. Stemp, 473001 W. Carey, 337005 T. H. Potter, 456001 C. S. M. Warwick, 90776 L. H. Barker, 27293 C. E. Evans, 497004 W. G. Mildinghall, 497231 J. H. Hawksworth, 457371 A. Savage, 301010 C. F. Stuart, 341206 H. Houghton, 475166 H. E. Philpott, 307077 W. B. Soutar, 473345 C. W. Geard, 510232 S. H. Sykes, 401153 L. W. Crossley, 354032 J. C. Wilson, 403494 E. Riddiough, 50038 H. Hodges, 392002 E. Handcock, 510036 J. G. Sinclair, 322003 G. M. Byers, 307048 J. J. Gordon, 36448 A. E. Curry, 492005 W. J. Wise, 499125 F. Toye, 437365 S. E. Foss, 36555 H. J. Stark, 23550 A. Keen, 32486 H. Sanders, 44863 F. L. Hearnshaw, 18427 P. Barber (M.M.), 495002 W. E. Hayward, 35273 A. E. Puttick, 11812 W. C. Banks, 37742 F. St. L. Gosley (D.C.M.), 34410 A. H. Purser, 12266 H. Parker, 14609 W. P. Oldridge, 18985 S. Shaw, 10898 A. J. Burke, 12264 W. G. Delamare (M.M.), 12944 C. Jackson, 16048 W. J. Taylor, 10400 T. F. Catley, 16097 E. Bowen, 11700 M. Stroud, 11465 H. G. Lenton, 17381 A. Gray, 17844 W. A. Clenshaw, 339021 J. Cavanagh, 26524 T. H. Garfield, 44572 R. G. Griggs, 32753 J. Q. Evans, 16440 R. Kildea, 14617 H. Ashton, 17159 C. Jones, 16524 H. Fandam, 17576 J. R. Ireson, 386029 A. N. Vinycomb, 27754 F. H. Partington, 24345 S. Donaldson, 21654 A. Gregg, 25261 J. Myers, 26191 E. A. Shilling, 26673 A. Weedall, 27273 J. D. Payne, 27225 W. Lee, 28275 E. Fleet, 388053 J. A. Brennan, 534499 F. W. J. Wheadon, 473180 G. Blows, 339016 T. J. Tinckler, 388004 R. Parker, 36453 W. Gay.

PROMOTIONS.

The following promotions to complete War Establishments will take effect from the dates specified:—

To be Quartermaster-Serjeants.

Dated March 16, 1918.—Staff-Serjeants: 352002 T. H. Kirk, 357021 G. W. Watson, 354030 G. H. Cooke, 536002 J. D. Harbinson, 89000 T. Ramsdon, 92650 F. R. Bray, 477008 E. Johnson, 426003 W. A. Towers, 538013 E. H. Burton, 437547 R. Baker, 89433 E. G. Collett, 439028 V. W. Anderson, 508513 J. C. Sandison, 390035 F. Larard, 368003 G. Cooke, 472004 H. J. Stoten,

357006 J. Wilkinson, 324002 J. Bowie, 512001 J. T. Boyes, 459004 S. Wood (M.M.), 481008 E. H. G. Mansfield, 90872 C. H. B. Fidoe, 467003 F. W. T. Blake, 324006 W. Paxton, 25876 E. B. Griffin, 467002 A. J. S. Pratt, 90052 H. V. Redman, 481001 H. S. Manning, 26001 G. C. Dick, 305003 W. Duncan, 545005 W. Hadingham, 473518 S. Preston, 527013 H. Body, 417039 P. A. Green, 461174 W. H. Teatum, 461158 T. J. Thompson, 461180 J. J. Bicknell, 316087 W. Thompson, 410204 F. H. Hilton, 421003 T. Wood (D.C.M.), 316049 A. Lamont, 435044 E. Capers, 92131 A. D. Haley, 437003 A. H. Dancer, 388008 E. Terry, 388005 J. J. Webster, 545028 F. D. Lewis, 527015 W. G. H. Greenfield, 545003 W. Gibb, 545043 A. V. Tier, 527005 H. B. Cragg, 527008 P. H. Greenwood (M.M.), 500008 W. Trott, 47733 A. E. Ford, 92390 E. Jones, 341034 W. Howard (M.M.), 426071 F. Brelsford, 315001 D. J. McMurray, 527010 S. P. Bristow, 459335 S. P. Redstone, 90454 A. Hay, 29364 T. Cawley, 318002 D. Macdonald, 93642 W. Greer, 545091 A. P. Piggott, 545113 G. Williams, 40053 W. McCarthy, 36001 P. A. Brunton, 32287 L. F. Ball, 56098 D. W. Hannan, 372009 F. W. Vearncombe, 417001 J. Chapman, 426005 A. M. Perkins, 512195 G. A. Fairman, 424001 T. W. Draper, 457007 L. Marks, 527018 S. B. Kenyon, 536006 A. Duckett, 40953 J. Cole, 32624 S. Kynaston, 332001 D. Kelly, 515012 E. H. Hobday, 545269 F. W. Delacour, 395001 J. Hunter, 534004 W. James, 8009 C. E. Grey, 25263 T. Bracewell, 9536 H. E. Mills, 9635 I. T. Rogers, 26096 A. W. Rowe, 26722 F. R. Jones, 25773 A. Vidgen, 26820 P. Harrington, 26818 H. Carrington, 26882 C. Pitkin, 28865 E. J. Brown, 26057 W. H. Ringham, 26942 W. Tims, 301241 L. G. Tough, 401424 A. F. Senior, 120112 G. Sangster, 412001 G. Morrell, 405254 S. Maccabe, 31411 G. Hooker, 37884 H. Orchard, 31148 J. C. Goad, 33408 F. W. Murch, 512317 H. E. Johnson, 344009 E. J. Richmond, 344010 G. Grant, 405256 C. E. Fowlston, 538371 P. E. Dimmock, 408299 A. Clarkson, 303076 W. M. Robertson, 459025 F. C. Roach, 497036 W. J. Rogers, 473070 W. C. Smith, 67737 R. Grant, 30907 R. R. Martin, 32204 V. Adams, 42403 F. M. Ault (M.M.), 30923 C. B. Symes, 37855 J. M. Lees, 310022 F. Rae, 545008 L. Skeeles, 473220 C. M. Coleman, 541019 H. G. Barnard, 40634 H. Marrison, 446004 R. W. Lee, 23334 J. Smith, 22493 S. House, 89504 C. G. Easton, 423002 W. L. Hampson, 59236 G. Garland, 393007 R. Messer, 328001 A. Coupe, 59277 J. W. Brown, 59277 R. Stevenson, 90778 E. Butler, 541012 L. G. Godden, 541043 C. S. Tanner, 527418 A. E. Beaumont, 527541 G. Shipley, 417007 J. Gratton (M.M.), 442020 C. J. Tidsall, 545267 D. Macleod, 35052 S. Holmes, 30147 C. Summers, 8008 P. G. Hayman, 25387 J. E. Barker, 25937 D. Cross, 27425 J. W. Halls.

To be Staff-Serjeants.

Dated March 16, 1918.—Serjeants: 526003 J. J. Hopkinson, 354061 W. A. S. Wright, 536005 W. G. Carroll (M.M.), 495007 W. Sharp (D.C.M.), 388011 W. T. Clark, 477004 J. Morris, 368009 A. L. Hopkins, 515010 H. F. Massen, 495006 W. F. Jenkins (D.C.M.), 493001 H. R. G. Spicer, 388006 V. Lawton, 405234 H. M. Heggie, 366429 E. Duncombe, 350039 T. Howard, 508019 H. Knightbridge, 508011 W. V. Galen, 495015 P. C. Pilcher, 363006 W. T. Vickery (M.M.), 305012 J. Crabbe, 303015 R. Fraser (D.C.M.), 350003 W. Mylchreest, 354004 A. E. Warhurst, 350040 C. G. Wardle, 403167 E. H. Collinson, 330017 C. Coyle, 553004 C. V. Bushby, 512016 A. B. Marshall, 90301 A. J. Sutherland, 386011 W. T. Charlton, 305016 M. Hunter (M.M.), 439012 W. G. Stewart (M.M.), 439055 W. G. Hobbs, 497015 W. H. Morley, 497078 W. Hebditch, 497079 T. H. Bray, 341004 C. McVitty, 534003 G. H. Joyce, 534017 J. W. Hancock (D.C.M.), 534023 G. Jeffreys, 32007 W. Stewart, 424002 T. W. Swabey, 417082 P. Kilmartin, 417006 W. Harrison, 538004 B. A. Williams, 405259 J. H. Preston, 455003 S. C. Flippance, 400094 J. W. Drummond, 339011 W. McDowall, 456005 R. S. Palmer, 536010 F. Burridge, 393009 T. L. Burkitt, 362002 W. Bateman, 339012 J. H. Thorp, 390037 A. Westerdale, 339026 C. Atherton, 433005 W. J. Davies, 386025 J. Dunn, 301925 J. F. Gillanders, 450002 F. E. T. Southby, 497086 C. E. Sheldon, 461185 G. Whitfield, 473093 A. Dickinson, 497050 B. G. E. Harper, 366431 R. Robinson, 417003 S. Blount, 512017 F. A. Ouston, 534048 R. Martin, 435583 J. Wilkins, 435587 G. Harriss, 446020 H. L. Overton, 401458 P. Maury (M.M.), 473007 A. G. Shrubb (M.M.), 403310 G. Blanchard, 372002 W. H. Howell, 543006 E. C. Chappell, 362032 A. Hopley, 301017 J. A. Charles, 341010 A. F. Hampson, 341023 J. Drury (D.C.M.), 401412 J. W. Johnston (M.M.), 341040 W. Gee (D.C.M.), 341088 C. V. Turner, 457068 W. H. Yendall, 92760 P. H. Jenkins, 417009 T. Benson, 382003 H. J. Morley, 510027 W. H. Cummings, 326004 G. Lithgow, 326006 J. Deans, 541014 J. Weir, 25377 C. T. P. Bewley, 25536 F. Hollingsworth, 9740 J. Wilkin, 25411 W. Forbes, 25334 J. W. Shelmerdine, 25295 T. Eglin, 25262 T. Fielding, 25908 H. Quinney, 8121 A. R. Miller, 316440 J. A. Shedden, 512005 G. R. Prior, 534037 E. A. H. Barnett, 512088 T. F. Nicholson, 352036 F. Gleave, 534039 A. H. Robson (M.M.), 410199 W. Nixon, 421016 H. L. Warner, 316429 D. Munro, 25447 D. McArthur, 472003 V. J. Tootell, 426006 C. J. Maddocks, 426031 S. H. Lowe, 25438 G. R. Gawthorpe, 92392 C. J. Marston, 350013 H. Golden, 30582 D. Harris, 26694 T. Chetwood, 27553 C. T. Green, 364023 T. E. Hopkins, 493180 A. G. Brace, 25717 W. S. Hilton, 25745 T. R. Nesbitt, 25754 J. Robinson, 354062 F. Clayton, 354180 J. H. Ashton (M.M.), 442043 R. Wynne, 33469 W. J. Ledbury, 26819 E. J. Coffey, 26824 W. Sumner, 90455 W. W. Roberts, 439569 R. E. L. Fox, 26832 E. Graham, 497005 H. Bosley, 405264 H. W. Allinson, 303056 A. L. Smith, 405281 H. W. Stuart, 405160 H. E. Crofts (M.M.), 472075 H. E. Chapman, 545044 F. A. Dolling, 455049 A. E. Fisher, 90820 W. E. Richens, 455034 J. M. Brinkworth, 38789 A. Onyon, 27106 A. H. Cashmore, 527042 G. H. Fowler, 28701 J. E. Morris, 459016 C. W. Finch, 459151 F. J. Henwood (M.M.), 92651 H. R. J. Rouse, 457013 R. Coleridge (M.M.), 337300 T. C. Lloyd, 120015 E. Lewis, 337211 J. Tickle (M.M.), 357111 S. Shaw, 27556 F. H. Bradley, 92586 A. E.

Rees, 337004 S. H. Brown, 92050 C. B. Warwick, 400107 E. Drummond, 27242 T. Jones, 42562 J. H. Heaton, 416024 H. Leavers, 550015 T. Cross, 419029 J. H. Cragg, 538060 T. H. Treadwell (M.M.), 421508 F. Eld, 423042 R. W. Wardman, 423056 W. N. Stansfield, 42844 T. S. Fairfull, 44301 W. Paul, 533014 H. S. Pierce, 368043 J. Newman, 439206 H. A. Pelley.

To be Serjeants.

Dated March 16, 1918.—Corporals: 400089 J. Fallon, 305008 C. Johnston, 93407 W. Cook, 89980 H. Fishersmith, 337022 W. Ousby, 92393 T. Spooner, 354063 J. Rafferty, 495024 H. Rowsell, 526002 R. Ashton, 459247 W. A. Jenkin, 510012 W. J. Sutton, 510014 C. Coker, 89983 B. Fenwick, 421022 F. Law, 362028 C. G. Faulkner, 92395 A. Whiting, 424003 H. Taylor, 400115 H. Varley, 512023 A. E. Whyte, 386021 R. Rickelton, 341013 W. L. Dean, 337048 P. E. Power, 339063 H. Allen, 93402 A. C. Smith, 90501 J. T. Tucker, 400123 A. Brooke, 89885 L. Speight, 456018 R. Bartholomew, 442002 J. Gilhooly, 483001 W. C. Sandey, 419059 J. A. Stanhope, 362041 W. V. Large, 320025 J. Kelly, 90225 J. McLean, 89510 J. W. Bennett, 433022 E. R. Sales, 318490 G. Millar, 493051 E. T. Brett, 390060 E. Jackson, 417056 F. King, 534052 T. Jewiss, 435590 H. W. Humphreys, 435588 R. J. Harris, 303085 N. McCormack, 456011 C. F. Hayman, 437063 B. Cross, 90004 L. Thurley, 538015 F. W. Hossack, 403480 F. E. Darby, 477012 G. Willmer, 493022 F. H. Woodbine, 352076 W. A. South, 457016 H. Hartwill, 320019 J. Watson, 536021 S C. Cole, 90053 F. J. Stevens (M.M.), 341008 A. Davies, 538043 G. E. D. Gale, 341050 J. Birchall (M.M.), 403586 P. B. Hare, 536043 C. R. Goddard, 90007 C. T. Hart, 388076 T. H. King, 320081 J. Dickson, 526027 F. J. Harris, 400014 A. Sellers, 473491 W. H. Ayers, 534009 G. S. Russell, 534024 W. T. Malin, 493034 J. A. Elmslie, 493035 W. Chittenden, 543010 C. Clark, 25006 G. Boyes, 25220 C. Smith, 25235 L. Kitchen, 26124 T. D. Seamer, 26769 C. Morgan. 8011 H. T. Rodd, 497032 A. Dickinson, 497076 F. Barker, 93248 J. Fullagar, 515019 W. H. Edey. 26355 R. Timms, 26354 J. W. Thornley, 9910 W. E. Kelly, 512010 A. E. R. Harris, 503019 T. Yates, 407025 A. A. Watt, 410202 T. Merrill, 9659 H. G. Williams, 301003 J. Morrice, 30532 H. W. Cresswell, 435530 J. E. Lucas, 26718 F. Hill, 493260 H. C. A. Clark, 25752 B. Robinson, 31409 C. Fry, 25757 E. M. Snowball, 34849 M. Brady, 25622 P. Ealding, 337074 J. W. Jones, 25964 W. Barnes, 32194 A. Park, 341082 C. Gabriel, 34795 A. E. Bowyer, 362048 E. Perry, 303030 A. Lyons, 363038 H. J. Roden, 33470 G. Edwards, 457119 C. W. Southcott, 35814 W. Gunn, 461294 L. Barrett, 303064 A. E. Wilson (M.M.), 405100 F. J. Hookham, 54722 A. Archer, 89644 T. H. Cole, 515029 A. Muddle, 455051 E. Harris, 88761 R. E. Lambert, 90663 E. M. Ferris, 90664 H. Green, 26980 A. Williams, 27538 J. E. B. Bartram, 42054 C. T. Newton, 46789 J. Martin, 92587 W. Parker, 459131 S. L. Porritt, 322004 J. P. Corlett, 449007 W. J. Vowles, 483023 E. Clarke, 457072 E. A. Bastin (M.M.), 350049 R. Scowcroft, 27318 G. Wardley, 27382 M. H. R. Perrot, 27485 J. Holmes, 39007 J. E. Smith, 459018 G. H. Crocker (M.M.), 42518 R. Holmes, 42544 J, Collinge, 419007 G. H. Horton, 419048 B. Dunkley, 416047 W. A. Cresswell, 419271 J. T. H. Mawbey, 400136 W. S. Lea, 417232 F. H. E. Hydes, 423018 F. A. Forrester, 42848 J. Duncan, 27824 T. W. Edwards, 439007 W. Clark, 439015 J. Carter, 300137 A. Alexander, 475054 S. Cornish, 44006 R. J. Harris, 417331 W. G. Thompson, 27927 W. P. J. W. Lowe, 475008 W. F. Spinks, 89647 W. H. Sidnell, 120036 J. Sugrue, 27867 A. Malton, 27982 F. Garner, 27984 W. J. Harrison, 44927 A. Shuttleworth. 44928 W. Stow, 421033 A. Barrett, 472015 W. F. Stimson, 439068 R. L. Burgess, 90008 F. F. Gregory, 481090 S. A. Webb, 500018 H. Goate, 8812 W. R. Watson.

To be Corporals.

Dated March 16, 1918.—Privates: 533023 F. C. Widdicombe, 528312 J. Hodgson, 352008 T. A. Chappell, 512036 A. C. Perrett, 378002 F. Jordan, 403550 H. H. Turner (M.M.), 457017 C. F. Dart, 350052 J. Wilkinson, 305031 A. Mitchell (M.M.), 386043 R. Gordon, 403567 J. Hillerby (M.M.), 354007 J. T. Barnett, 434013 W. J. Bird, 473020 E. W. Sparrow, 341033 T. Pinkney (D.C.M.), 339047 W. T. Carvick, 456014 J. Green (D.C.M.), 388048 F. Guy, 339049 C. A. Strange, 364050 S. Holvey, 352083 J. H. Clough, 477035 W. J. Frost, 412011 H. Oates, 439061 J. Savery 533020 C. Tonking, 433024 A. Hemming (M.M.), 472021 C. Linger, 433025 H. D. Edge, 461211 H. G. H. Williams, 477051 C. Hernaman, 4611[illegible] C. A. Walker, 456016 C. J. Fielden, 362064 F. Taylor, 534079 H. Wykes, 324014 W. G. Tait, 405009 F. Turton, 303051 A. Christie, 493127 J. Woodward, 499157 A. Coleby, 341112 J. O. Blackmore (M.M.). 354086 A. Hill, 405031 J. F. Wilkihson, 493135 A. T. Hoad, 508060 W. J. D. Carter, 316041 W. D. Fothergill, 352114 H. Lodge, 386139 H. P. Hudson, 437098 H. L. Rowe (M.M.), 400019 S. Burridge, 475102 R. Knight, 301116 J. Forsyth, 439156 E. Eastment, 442431 H. Evens, 33044 T. Edkins, 500039 A. G. Boxell, 405094 B. Cox, 8275 H. J. Millgrove, 527058 A. Thompson, 500054 A. Trusler, 500050 E. Brooke, 7925 H. Ernest, 416019 L. Meats, 435563 L. Ratcliffe, 401039 A. Daniels, 442023 A. W. Fisher, 512127 A. F. Hartley, 512130 H. B. P. Owen, 527063 A. H. Scrivener, 324020 D. A. Glennie, 9481 J. A. Biggs, 26662 J. H. Staton, 446043 C. F. Lucas, 495155 L. Small, 30325 J. H. Barker (M.M.), 25893 E. G. L'Estrange, 9237 W J. Gallagher, 366118 T. Jones, 8671 T. Mooney (M.M.), 9164 J. Macdonald, 515041 W. E. Birkett, 30381 K. L. Jones, 328014 J. Wright, 9788 P. E. Batten, 536144 F. A. Smeed (M.M.), 30944 J. Kerr, 26657 T. Richardson, 30880 A. Cheal, 30804 J. Scott, 31323 W. Wright, 30682 T. C. Cooper, 419147 W. Hitchcock, 551019 T. H. Bailey, 538212 R. Capell (M.M), 47403 A. Flear (M.M.), 30771 R. Garland, 31807 G. W. Pollard, 337186 B. J. Smith, 538285 H.

Symons (M.M.), 30753 C. H. Tanner, 533032 R. C. Brischlayer, 475123 C. R. Chamberlin, 354160 C. O. Connor, 441163 L. C. Fehrenbach, 527144 S. Hands, 40064 B. Rowley, 533065 F. Sharp, 493261 A. Upton, 350197 G. A. Walton (D.C.M.), 32045 T. Aitken, 32052 J. W. Bacon 32028 W. J. Bayliss (M.M.), 34932 W. H. Clifft, 538219 J. Coxhill, 31224 E. Dadge, 21223 W. C. Davis (M.M.), 31760 C. P. Dunscombe, 39741 J. Gallimore (D.C.M.), 32220 W. N. Haseldine (M.M.), 31622 E. C. F. Humphrey, 533062 W. J. Ralph, 512166 J. E. Wickens, 536150 G. C. Battson, 421168 W. Connolly, 32750 F. S. Davies, 341263 O. Dolan (M.M.), 536358 A. J. Newquist, 36282 F. Ralph, 461029 A. Reed, 341362 W. Shadwell, 32509 R. G. Wardrop (D.C.M., M.M.), 32702 A. Appleby, 32707 A. E. Brown. 32306 J. Enright, 36182 P. Hughes, 477148 R. Jack, 26648 C. Piercy, 477346 G. J. Prior, 32989 H. V. Turton, 318114 J. C. Borland, 32276 T. Boyd (M.M.), 34006 A. T. Bradford, 545055 W. T. Carter, 34041 E. Ellidge, 32602 T. T. Fawley, 33554 G. M. Gilbert, 33925 A. C. Imrie, 32343 S. Kay, 32463 M. Sanders, 34230 B. Smith, 36363 C. E. Ward, 33644 W. Blackmore, 33907 H. J. M. Chilton, 33527 E. W. Cooke, 40231 W. Tottle, 32705 W. Alford, 33663 A. E. Collard, 508215 J. Jessett, 32949 J. R. Marvin, 40350 W. Murray, 33376 W. Trigger, 40001 A. W. Allen, 25716 T. Hardisty, 533135 P. M. Stallard, 315079 A. Craig, 337258 E. J. Gibson, 34771 H. Howe, 39453 R. Ogle, 315084 W. Stevenson, 512256 J. F. Golding, 337280 B. D. Lloyd, 34317 C. McCarthy, 33958, J. McNab, 457286 N. H. Mitchell, 40368 J. A. Mincher, 40369 W. Morris, 34599 T. G. Riseley, 37353 B. J. Hodges, 37184 A. Partridge, 37190 M. H. Powell, 35559 R. G. Tilt, 33892 G. Waddilove, 36082 R. E. Owen, 35423 T. Cheadle, 33747 G. S. Blow (M.M.), 35752 G. Burditt, 54345 C. C. Burns, 339201 S. Goodman, 320187 J. A. McMurtrie, 34466 C. E. Spence, 477328 H. Wright, 36570 H. J. Biven, 311003 J. Chalmers, 36406 J. W. Gregory, 416050 W. S. Schofield, 37761 G. W. Toplis, 35943 H. C. Watson, 35715 C. R. Baker, 35359 T. Morrin, 388194 W. Calvert, 35293 A. Wood, 38857 J. Mason, 35154 S. Ogden, 390218 R. Atkinson, 36792 G. W. Barrett, 38820 F. Kay, 38821 V. J. Kennard, 37945 H. Norman, 39156 C. P. Wilkinson, 527086 E. C. Nash, 39308 W. M. Allison, 527093 W. E. Ostler, 37507 W. Elliott, 39747 S. Hogg, 39407 C. H. Brown, 37322 L. Cassidy, 40888 G. E. Wrightson, 527119 H. S. Barnett, 36686 T. Walker, 26997 D. W. Aubrey, 27024 A. Lewis, 27039 J. Williams, 37577 J. Payne, 38666 E. Hickling (M.M.), 45987 W. O'Connell, 339326 F. Patton, 545086 H. Brown, 38577 E. W. Drury, 39543 G. A. Kings, 510285 H. C. Smith, 38484 A. G. Webber, 38562 W. C. Clinch, 39340 J. R. Dixon, 423148 A. Greenwood, 41896 H. B. Hollyer, 38270 S. Tucker, 37473 W. H. Nixon, 38754 W. G. Gibson, 37849 D. Hall, 545098 F. B. Loughlin, 38370 S. Tilley, 41527 F. Dutton (M.M.), 421181 F. Sayfritz, 41525 R. H. V. Dixon, 40720 F. Martin, 42450 E. Hawksworth, 416057 J. Fawcett, 401160 G. D. Summerscales (M.M.), 40202 J. Bardsley, 527172 R. W. D. Beckett, 416067 A. S. Clarke, 45739 W. Dollar, 40180 T. Kane, 344055 T. Swindlehurst, 330032 G. Hodge, 43568 M. Wheelhouse, 324056 A. Dawson, 41666 F. Hartnell, 44877 H. Slee, 495211 J. T. Hadlow (M.M.), 41676 I. Jacob, 416074 W. Robinson, 41772 P. Rowell, 45929 A. Walker, 40197 W. Mills, 42914 W. J. Bunting, 40789 D. Davies, 41428 W. A. Hoyer, 393056 W. G. Ridley, 545138 T. F. C. Hughes, 43674 D. Munro, 44623 W. D. Campbell, 473257 F. D. Fox, 546257 W. L. Willcocks, 423051 H. W. Bricsoe, 43611 H. Greenhalgh, 43127 A. Hope, 41962 A. Melson 43160 J. Overton, 43995 T. L. Vipond, 43722 R. F. Scott, 368136 T. Williams, 27727 F. Williamson, 43194 W. H Wood, 45586 W. A. Fletcher, 44367 R. Jones, 42692 W. Miller, 45513 A. R. Ansell, 43931 T. Hegarty (M.M.), 43445 H. Emberton, 27774 G. Carr, 44285, J. E. Leach, 44299 R. W. Passey, 43584 P. Swift, 44288 F. J. Jones, 44281 H. Lavender, 44295 E. Pryer, 27653 W. Cope, 45407 A. C. Hamilton, 45281 G. Rodger, 45298 D. W. Venters, 480011 A. A. Dant, 46435 H. S. Morgan, 46035 G. Coulson, 500100 C. G. Earl, 45127 R. A. Dampier, 54071 F. W. Greenaway, 46188 G. C. Hollier, 45289 L. O. Walford (M.M.), 366175 J. Salmon, 46555 J. Gray, 481082 S. C. Owen, 339388 W. H. Kendrick, 527244 W. A. Ellis, 301308 J. Aitken (M.M.), 27954 T. Kerswill, 47075 R. Hedley, 392042 W. W. Young, 417381 J. Conlon, 46965 E. J. Crothers, 47134 J. Burrell, 538567 E. J. Jones, 28350 J. W. Jowitt, 538330 F. J. Wagnall, 546265 S. H. Cracknell, 46905 F. Maxfield, 46916 F. Roberts, 545184 D. S. Noble, 382016 J. A. Milner, 47160 H. Clarke, 534337 H. J. Parrett, 515065 C. Bradford, 343058 J. W. Pattinson, 545211 W. Moreland, 461455 P. J. Aslatt (M.M.), 350318 H. Wallwork, 545221 S. S. Proud, 515068 J. W. Cummins, 459351 W. B. Goodenough, 515070 W. W. Woodcock, 328031 J. Leitch, 386332 R. Cook, 419316 S. W. Harbot, 527228 A. J. Wheeler, 545279 E. O. Stannard, 448004 A. Deaney, 47732 W. Hogg, 461484 H. Blakeley (M.M.), 441159 E. W. Harrison, 527253 W. R. Jackson, 47633 G. Wright, 410067 A. Coward, 47762 J. G. Dobbin, 545310 T. Jones, 545303 H. Smith, 527276 R. B. Hobson, 388294 M. Strong, 48428 T. Owen, 52012 T. W. Davenport, 53724 W. Ross, 48462 F. A. Tarling, 49125 J. T. Moran, 52025 A. Redhead, 49502 E. Robison, 49454 H. T. Green, 53682 T. Pattenden, 50057 B. Harrison, 49556 W. E. Bower, 54162 J. R. Axten, 50011 A. R. Beacon, 50008 F. W. Burrows, 50048 S. Hart, 49892 W. Kirwin, 49983 H. Bottomley, 54221 W. Forbes, 50615 T. Manifold, 29139 W. D. Jones, (D.C.M.), 513251 H. E. Rayson, 52660 L. Gibson, 51589 D. Cameron, 50222 F. Alden, 50949 T. Callaghan, 51650 J. W. Phillips, 341484 A. Brooks, 54163 R. Cowe, 51671 H. J. Rowlands, 51755 D. C. Watt, 51778 E. A. Wayman, 51382 S. Clinch, 51466 J. Hodkinson, 51843 L. Gaulton, 53592 S. Cairns. 51916 J. Little, 52066 A. E. Tipping, 51898 H. W. Joslin, 51797 C. Dex, 51888 E. J. Jones, 52884 F. R. Spinks, 52260 G. Fraser, 52895 A. Schofield, 52189 W. Bowen, 52886 F. R. Searley, 52229 T. G. Dingley, 52371 A. Leese, 541052 S. A. Maycock, 52390 L. Morris, 500247 F. Ovenden, 53573 S. S. Arden, 53233 J. Byers, 52197 J. Carrington, 52905 A. J. Stallard, 52930 F. Twells, 479007 F. T. Garwood, 495422 L. G. Craft

(M.M.), 53014 A. J. Weller, 55141 A. Brennan, 55165 M. L. Hailing, 388449 W. J. Eales, 48528 T. McCann, 55363 D. McL. V. Turnbull, 370009 E. Wilson, 528199 H. Gresswell, 29533 F. J. H. Martin, 29537 W. R. Richards, 55817 P. Stephenson, 441060 F. E. Bayliss, 56001 W. H. P. Busson, 56064 G. W. Jones, 56214 J. Noble, 48538 R. H. Jones, 56767 A. Archibald, 56858 M. Sheedy, 56850 H. Bradley, 56956 E. Johnson, 56951 H. Pickering, 57530 J. A. Corkill, 545426 T. W. G. Farrant, 545437 A. M. Hill, 57338 J. Sill, 57670 H. O. Le Patourel, 71288 J Wicks, 54839 M. McManus, 423093 F. Bodkin, 527478 D. Harvey, 527480 A. H. Payne, 395004 T. W. Tindale, 515079 W. G. Clark, 495468 C. Herbert, 545530 W. D. H. Smith, 426116 A. E. Turner, 527539 J. W. Rawdon, 527540 T. W. Rothwell, 527543 J. W. Whittock, 527547 H. W. King, 545536 W. J. Povey, 88620 G. R. Gough, 24598 E. W. Muffitt, 24340 G. F. Stainthorpe, 527579 E. A. Hunting, 58010 W. Fairweather, 540094 W. Nelson, 392117 A. Douglas, 58006 H. Edge, 57981 J. G. Reid, 58097 A. J. Tait (M.M.), 371016 N. Smith, 58070 J. Guiney, 403528 F. Watkinson (M. M.), 357177 V. Fryer, 493628 H. J. Sanders (M.M.), 426161 H. Briggs, 316293 W. S. Donald (D.C.M.), 545613 C. Hazel, 497482 T. H. Hill, 54753 R. MacKay (M.M.), 481129 S. C. Squires, 58470 C. F. Taylor (M.M.), 58752 J. McTurk (M.M.), 58662 H. W. Brocket, 357222 G. M. Groves, 527620 S. Keene, 545637 W. J. Gravestock, 545869 A. P. Ling, 527680 A. Mason, 59013 C. H. Harker, 59465 H. H. Lewis, 59124 H. Thomas, 59163 F. J. Eavers, 439497 T. E. Slade, 59353 R. T. Sugar, 79788 D. McCallum, 437411 R. J. Oakes, 59424 F. M. Jeffery, 59764 C. Grice, 59579 F. C. Highfield, 59583 A. R. Savage, 59705 C. J. Conquest, 435438 H. L. Hazleton, 60040 J. D. Perritt, 442252 J. E. Bradshaw, 60139 J. I. Corlett, 60140 R. H. Corlett, 60110 F. W. C. Gregory, 59956 H. Jones, 308095 W. H. Thom, 527722 R. J. Smithson, 527700 C. C. Summers, 60295 S. Kerry, 441158 H. Brook, 60289 S. Hayward, 352432 T. Hoyle, 545684 W. F. Mason, 527740 H. S. Smith, 60807 C. W. Hillarby, 514066 H. E. Stacey, 61004 J. Rowan, 61051 H. J. Harris (M.M.), 61087 H. Boot, 61017 W. Kay, 324078 H. J. Alexander, 439025 J. H. Baker (M.M.), 481209 A. J. Carter, 61607 J. H. Choice, 545759 A. S. Danbury, 61731 G. T. Gabe, 444126 J. Mansfield, 61794 T. Taylor, 479069 A. S. Dobson, 527767 W. P. Osborne, 62166 W. Lattin, 65192 M. Harvie, 61261 G. E. Lawton, 62284 W. B. Randall, 62355 J. Mann, 459486 P. H. Wadge, 527797 C. H. Hobbs, 62469 W. Walford, 66207 A. E. Cutler, 65342 H. J. Heselton, 303360 J. Hume, 62776 J. Shaw, 62873 C. E. Binion (M.M.), 62937 R. Duck, 63042 J. Elliott, 63131 H. H. Birchall, 63034 H. Bradshaw, 63035 I. Parker, 63338 C. G. D. Hawkes, 500191 S. Pinkney, 541170 L. R. Bingham, 393252 T. Stead, 63623 W. D. Vaughan, 519016 L. Whitehead, 67264 H. Ellison, 64685 J. Leslie, 64735 C. E. Leeson, 326088 J. A. Taylor, 66508 J. McGregor, 546116 H. Watkins, 66570 G. S. Fletcher, 64821 G. Hunter, 102211 F. Hulme, 68375 H. Storry (M.M.), 68999 E. Ainscow, 354508 J. H. Seddon, 66630 J. E. V. Crofts, 64911 A. T. Hope, 356007 L. Baldwin, 69360 H. Kay, 65980 C. A. Hemming, 72129 A. Whybrew, 66885 G. W. Bryant, 69935 J. A. Bance, 70061 P. Griffiths, 72205 G. H. Liner, 72182 W. Parker, 72169 W. C. Daniels (M.M.), 70677 P. Jackson, 72381 W. Gammage, 72315 S. Addington, 72337 A. H. Loasby, 546085 A. A. Godman, 71693 J. W. Haigh, 73635 J. E. Underwood, 372363 W. J. Woodfield, 75636 J. W. Bramhill (M.M.), 77391 J. S. Christian, 73745 A. W. Grattidge, 74606 L. S. Jeffs, 508504 L. C. Webb, 73784 C. E. Williamson, 73833 F. Caudwell, 73999 F. P. Harrison, 77890 R. M. Jones, 73924 H. Brookhouse, 546016 C. Chapman, 76850 A. E. Day, 103243 J. J. Rafter, 76153 T. P. Thomas, 79257 A. E. Aston, 77079 H. Holt, 77174 J. A. Wall, 81059 M. C. Wilson, 546179 A. Baxter, 79108 T. E. Morgan, 528056 C. D. Bright, 78433 H. E. Strachan, 80946 S. T. Channer, 322061 H. F. Thompson. 481296 B. L. Chapman, 83805 E. E. Back, 79112 A. E. Holmes, 79376 P. A. Skinner. 82195 W. Ashworth, 79381 J. W. Cuedren, 493728 R. Seymour, 493717 G. G. Galpin, 79371 S. A. Best. 79388 L. Chidley, 79741 H. Harrison, 79810 R. H. Gould, 412031 F. F. Fulker, 83741 J. P. Faulkner, 528233 H. W. Gill, 83779 W. H. Jones, 79498 T. W. Winstanley, 83806 R. G. Roberts, 528239 L. W. Day, 79566 P. D. Housley, 428023 D. Hurst, 83810 A. B. Abel, 79808 E. G. Bate, 83695 A. O. Griffiths, 79571 T. Jacques, 83702 J. Jenkins, 83710 E. Miles, 83711 D. Morgan, 79797 H. T. Cogar, 105818 J. Bancroft, 79764 F. W. Dabbs, 79767 W. E. Ward, 79769 C. Whomersley, 79765 B. Wigmore, 83715 E. C. Phillips, 528123 E. Lamb, 81753 W. R. Morris, 81947 R. B. Wilkie, 83760 G. C. Crummack, 83815 J. M. B. King, 84825 M. Allsopp, 84122 J. W. Bowmer, 543166 W. H. F. Stump, 99697 J. B. Bower, 316474 J. L. Garland.

Dated March 30, 1918.—Privates: 508611 J. Turner, 84679 W. Burke, 86198 J. W. Gardner.

These promotions are subject to the conditions laid down in paragraph 35, Standing Orders for the Royal Army Medical Corps, 1914.

Temporary Promotions.

The following temporary promotions to complete War Establishment will take effect from the date specified :—

To be Temporary Serjeant-Majors.

Dated March 16, 1918.—Quartermaster-Serjeants: 322107 D. M. Kerr, 90466 G. R. Smith, 90543 G. J. Pittman, 459009 R. Old, 457003 A. E. Sharland, 28548 H. Moore, 32014 H. W. Wilkins, 315003 A. P. Anderson, 93660 W. Paul, 32268 T. W. Allcard, 16053 S. M. Gawthorne, 18415 A. Bell, 538584 J. Ott, 11807 J. Levey, 14770 A. Buckner, 13544 E. J. Barnes, 17633 R. Sproule (M.M.), 536478 H. E. Pierce, 15843 W. Stokes, 16205 T. Gregson, 16569 E. Attfield, 14326 W. P. S. Morman, 18453 F. A. Philbrook, 17748 C. H. Dissent, 18216 R. G. Leggett (D.C.M.), 18976 E. G. Robinson, 18337 C. Leaker, 417461 F. J. Steele, 18432 G. F. Pearce,

18445 J. E. Crawley, 17928 W. S. Toye, 18385 F. W. Coupland, 18645 C. E. Rouse, 12461 P. F. Cook, 15288 W. C. Prince (M.M.), 15591 J. Harris, 15813 A. V. Heggie, 18948 E. Moore, 15671 R. W. Cole, 15483 E. Sharp, 17057 M. Ward, 11736 J. D. Keeble, 18969 E. Gray, 18032 T. Kerr. 90488 E. Savage, 12989 E. G. W. Barnes, 16678 J. E. March, 11614 W. H. Howard, 18222 A. Dady, 89700 E. J. Batchelor, 14761 W. Robertson, 12819 W. H. Riches, 318344 J. Macfarlane, 508250 W. J. Perch, 17573 C. Harlen, 13035 G. V. Chandler, 17358 C. Ennor, 12709 H. J. Ford, 26999 I. H. Caple, 17091 J. Moore, 19320 H. A. Ritchie (M.M.), 103 G. P. Steer, 475107 W. F. A. Way, 465010 E. Pillar, 12065 A. A. E. McKnight.

These temporary promotions are subject to the conditions laid down in paragraph 35 Standing Orders for the Royal Army Medical Corps, 1914.

ADJUSTMENT OF RANK.

The following Acting Serjeant-Majors are promoted to the rank of Temporary Serjeant-Major from the dates specified :—

To be Temporary Serjeant-Majors.

Dated May 2, 1917.—Acting Serjeant-Majors: 517001 W. H. Ford, 515001 W. J. Cabburn, 467001 H. B. Dotterill, 393001 J. Tunnah, 410193 W. J. Hemphill, 308001 G. A. Walker, 393003 T. K. Megoran, 426004 E. T. Earp, 324001 A. J. Edwards, 372001, W. T. Worth, 446023 H. Andrews, 357001 W. Ball, 465002 J. D. Griffiths, 465009 C. H. Gill, 472005 T. W. Smith, 493320 W. W. Weeden, 417013 R. H. Farr, 410194 R. Whitworth, 423001 S. C. Greenwood, 357030 L. J. Riley, 459002 T. W. Parsons, 316023 D. Ritchie, 390001 R. Edwards, 457001 A. E. R. House, 341411 F. C. Scrutton, 541048 C. E. Smith, 408032 A. R. Reiliy, 339006 D. G. Martin, 305002 R Duncan, 343069 J. Leighton, 320001 T. M. Weldon, 481381 I. O. Race, 424009 J. T. Coles, 370033 A. W. Marks, 344002 W. E. S. Waring, 459049 R. A. Elliott, 461337 T. B. Whitfield, 408050 T. H. Brunton, 364003 W. C. Scott, 437006 H. C. Jackson, 457005 G. E. Callard, 408028 G. W. Steel, 320392 A. Reid, 400087 T. H. Armstrong, 495117 D. G. Mather, 366193 W. J. F. Phelps, 480002 R. W. Allpress, 508059 F. A. Smith, 459009 A. E. Darley, 308002 A. L. Gauld, 465003 J. Ball, 463001 J. J. Baker, 337006 R. E. Williams, 419001 A. W. Thorne, 339015 D. J. Dakin, 481004 C. Constable, 339005 A. Viddler, 533001 G. A. Judd, 372018 J. Morgan, 354015 E. W. Langford, 350004 C. Bonehill, 34099 J. Parr, 426002 T. A. Towers, 300004 J. Sinclair, 499002 T. G. A. Sheppard, 519031 J. J. Bird, 326005 H. A. Ramsay, 475007 E. J. Spinks, 341003 J. Wilson, 356001 T. E. Carter, 416022 J. J. Abbott, 337023 J. Dalton, 461170 S. C. Pocock, 372004 S. C. Turner, 439018 J. Creese, 390017 H. N. Browne, 417055 A. King, 435001 J. Bode, 473508 C. W. Baker, 493006 C. Abnett, 536001 H. E. Bevans, 322001 E. G. Gray, 492001 W. H. Ingamells, 497003 H. G. Freeman, 328003 A. Irvine, 510007 A. W. Burton, 408002 C. Morrell, 326012 J. Stewart, 481003 B. G. Clarke, 311022 R. Clarke, 343142 G. Wilkins, 433001 J. H. Blackwell, 444021 J. V. Loney, 423101 J. P. Flavill, 350002 W. Jarman, 339009 G. W. Isaacs, 446001 W. E. Dore, 473244 F. G. Elsden, 416026 G. S. Jackson, 307051 J. B. Calder, 388001 W. Parker, 368001 F. T. Rowe, 456004 F. S. Holmes, 403196 J. W. McCandlish, 318004 W. Millar, 541010 H. A. Walden, 442019 G. L. Stiles, 543005 F. S. Booth, 352199 F. Williams, 339010 B. Benson, 388018 J. Clough, 328018 J. D. Scrimgeour, 405518 C. H. Harrington, 401416 J. Kelly, 392007 W. Potts, 366011 T. Burnard, 514001 W. R. Gillett, 424056 J. C. Walker, 467067 W. R. Stoakes, 512196 H. E. Young, 407054 J. R. Greer, 444008 H. C. Pedrick, 543026 E. Strong, 515002 G. Cowie, 543001 A. A. Daw, 543001 C. A. Wingate, 426054 G. A. Ball, 442010 G. C. Corbett.

Dated May 16, 1917.—Acting Serjt.-Major: 473235 F. Edmonds.

Dated May 23, 1917.—Acting Serjt.-Major 435485 H. O. Wheeldon.

Dated May 24, 1917.—Acting Serjt.-Majors: 500001 W. Poole, 500002 W. C. Maidlow, 500006 R. H. Ballard.

Dated May 26, 1917.—Acting Serjt.-Major 303001 A. Mackray.

Dated June 1, 1917.—Acting Serjt.-Major 540055 F. H. Hankins.

Dated June 6, 1917.—Acting Serjt.-Major 519021 H. H. Bond.

Dated June 19, 1917.—Acting Serjt.-Major 538276 W. H. Scrutton.

Dated June 25, 1917.—Acting Serjt.-Major 512019 J. C. Caswell.

Dated June 26, 1917.—Acting Serjt.-Major 386014 P. T. Pickard.

Dated July 3, 1917.—Acting Serjt.-Major 538086 T. Burrows.

Dated July 5, 1917.—Acting Serjt.-Major 536018 C. Gillard.

Dated July 6, 1917.—Acting Serjt.-Major 337283 F. Fowles.

Dated July 18, 1917.—Acting Serjt.-Major 421013 W. J. Bastone.

Dated July 19, 1917.—Acting Serjt.-Majors 510201 F. Hopkins, 341430 R. R. Parry.

Dated July 24, 1917.—Acting Serjt.-Major 434002 F. W. Nichols.

Dated July 28, 1917.—Acting Serjt.-Major 437009 G. Rutter.

Dated August 2, 1917.—Acting Serjt.-Major 354020 E. Roberts.

Dated August 6, 1917.—Acting Serjt.-Major 540037 F. B. Challis.

Dated August 13, 1917.—Acting Serjt.-Major 515028 C. F. Palmer.

Dated August 18, 1917.—Acting Serjt.-Major 508003 S. T. Love.

Dated August 23, 1917.—Acting Serjt.-Major 407011 B. E. Crossley.

Dated August 25, 1917.—Acting Serjt. Major 301230 W. T. J. Davis.

Dated August 28, 1917.—Acting Serjt.-Major 477018 W. T. Holbrook.
Dated November 1, 1917.—Acting Serjt.-Major 403033 H. L. Moss.
Dated November 2, 1917.—Acting Serjt.-Major 352032 L. H. Robinson.
Dated November 18, 1917.—Acting Serjt.-Major 534233 H. Hubbard.

These temporary promotions have previously been published in Special Corps Orders issued from this Office, and are now published for general information.

ADVANCEMENT OF PRIVATES—CORPS PAY.

The following advancements in rate of Corps Pay will take effect from March 16, 1918.

To be Advanced to Third Rate (at 8d.).

As Orderlies.

22457 W. O. Dixon, 23196 S. H. Elliott, 24975 A. Brook, 104720 J. Wilson, 106691 G. E. Pates, 33160 A. F. Reynolds, 35546 P. J. Parriss, 43732 J. Smith, 50625 E. Nowell, 52190 D. Buchanan, 55134 D. T. Makinson, 55715 F. Dalby, 56557 J. Campbell, 58484 J. F. P. Ford, 58561 J. Marland, 59149 J. L. Pengelly, 69832 F. J. Pritchard, 75643 F. H. Grime, 78616 J. A. Wallett, 92142 F. E. Norman, 311057 E. G. Bell, 324040 W. Wilson, 341173 R. Sheilds, 341530 J. Duckworth, 350256 W. E. Morpeth, 401275 C. R. Gallant, 408148 T. Shannon, 434068 F. G. Birmingham, 442325 W. K. Winfield, 473187 D. L. Saberton, 514070 E. Campion, 515063 C. R. Roberts, 22474 H. W. Gillett, 23206 C. H. Gordon, 26499 J. E. Morris, 104275 M. Reid, 104802 C. S. Bassham, 32547 A. Chamberlain, 33524 J. E. Brown, 41796 J. Whetstone, 50758 J. Smith, 52414 J. McCann, 55373 T. Mannion, 55778 T. Kelly, 57666 S. Gill, 58488 A. E. Furniss, 58565 H. Owens, 59364 C. W. Unwin, 70137 H. Fortune, 77570 J. Waugh, 82347 W. Goode, 301110 J. Sheddon, 311074 W. Pratt, 324043 H. Dalgleish, 341313 T. Jameson, 344111 S. Keepe, 352156 V. Hinson, 407003 H. Miller, 426245 B. B. Lidster, 441036 A. Hunt, 444039 P. Dabinett, 514008 E. F. Parsons, 514072 W. C. Bruce, 515095 R. Reynolds, 23047 B. Rhodes, 24492 T. D. Dawson, 101303 E. Groves, 104586 J. McHoull, 105421 C. Roberts, 33035 C. Collett, 34360 T. Wainwright 43435 W. Dewhurst, 45280 E. W. Rolley, 50986 H. F. Goose, 53071 W. Moore, 55566 R. Bass, 56535 G. A. Poole, 658482 H. Glasby, 58838 I. Taylor, 58983 W. Fletcher, 63494 A. Wallace, 70311 A. Radcliffe, 78603 S. Howcroft, 92141 C. A. Foy, 301313 N. Kitson, 320159 J. C. Imrie, 341158 L. Webster, 341449 H. Gravener, 350120 E. Bibby, 354026 S. Watson, 408146 H. W. Pratt, 433053 E. Whitfield, 463073 W. J. Sutton, 514050 R. E. Brown, 515026 V. C. Egles, 517030 S. H. Banks.

As Clerks.

33322 T. E. Roberts, 45204 F. Broadbent, 63615 J. Lancaster, 68879 W. Russell, 75775 P. S. Smalley, 77842 W. Gibson, 79579 F. C. Bond, 81142 J. R. Morrell, 83290 W. G. Ratcliffe, 89994 J. R. Matthews, 8532 J. W. Wallis, 106455 C. P. Simpson, 341696 G. H. Watkins, 344164 S. Maxwell, 393293 C. E. Thirwell, 433113 B. W. Blasdale, 446132 W. F. Beesley, 508091 A. Lusby. 512516 F. W. Loveland, 515139 R. J. N. Tutt, 37347 H. Hall, 53044 E. G. Bailey, 65845 A. S. Mayers, 71929 A. Wright, 76450 F. W. Bramley, 79256 J. A. Wardle, 79649 P. Viner, 82120 C. F. Campbell, 87603 W. T. Stanley, 95084 F. C. Clarke, 100805 L. E. Swift, 337230 C. F. Dawson, 344148 R. Hemphill, 350540 E. Littlejohn, 393301 J. E. Ulliott, 437079 W. Smith, 493316 D. P. Gibbons, 510057 W. G. Waldron, 515101 H. C. Cox, 519044 M. Hamber, 41520 R. Clayton, 53580 L. C. Bryer, 68733 A. E. Sharp, 73976 F. W. Page, 76526 A. E. Richards, 79258 T. S. Ward, 80824 G. O. Graves, 83282 R. W. A. McDonald, 87700 I. Goodaire, 95141 L. Hudson, 104078 A. C. Summerfield, 337760 W. O'Hare, 344163 J. J. Brennen, 364151 E. D. Phelps, 410051 B. Talford, 446090 E. J. Beck, 497114 C. H. Yeabsley, 50325 P. J. Bales, 515112 F. Sedgley, 533106 S. E. Shore.

To be Advanced to the Fourth Rate (at 6d.).

As Orderlies.

30342 F. Dorey, 31039 G. Price, 31904 W. Parsons, 33702 A. Allam, 33854 T. Parker, 34439 F. Russell, 35224 V. Dower, 35781 J. Cahill, 36512 L. A. Bennett, 36568 W. L. Stone, 36592 G. E. Barlow, 38097 J. Pickston, 39983 J. T. D. Cook, 40941 S. Campbell, 41808 E. G. Bridges, 42464 T. S. Leigh, 43553 C. W. Thompson, 101421 W. Taylor, 9583 J. E. Maddock, 21055 H. Crowson, 21430 F. H. Stansfield, 21732 W. Holliday, 21912 H. Kerry, 311086 R. J. Wedderspoon, 316434 W. Henderson, 324026 A. Stanley, 324092 P. Hainey, 337187 L. Cox, 337718 H. Price, 341251 F. Cox, 344089 J. H. Carter, 344145 T. Jones, 30872 H. King, 31832 A. Moate, 32535 S. Bretherton, 32715 J. Bucknall, 34191 J. MacDonald, 34463 R. Stephens, 35431 A. Dregnan, 35821 E. Fisher, 36538 A. Bower, 36571 T. Bourne, 39649 J. McCabe, 40162 J. Collier, 42296 J. J. Taylor, 42469 D. V. Lewis, 43644 A. Jones, 21998 J. D. Parkinson, 9641 O. Edwards, 21196 J. Bateman, 21523 W. Lawton, 21811 S. Brown, 301190 J. Buchan, 311036 W. Marlow, 316251 W. Fox, 316442 R. B. Kinloch, 324076 D. B. Doughty, 326044 P. F. C. Peters, 337540 J. H. Costain, 339094 G. Pennington, 341351 W. Parr, 344126 J. Kenyon, 344140 W. Whalley, 30090 R. D. Bridgeman, 31833 F. J. Rapley, 32626 H. C. Lever, 32748 S. Devlin, 34993 H. Lazenby, 35579 J. W. Sharples, 36506 W. Hyde, 36549 W. A. Madden, 36965 W. H. Hems, 39770 D. E. Harries, 41150 J. Armstrong, 42436 S. Devine, 42923 J. A. Chesworth, 43836 A.

Crook, 9667 A. O. Davies, 21246 A. H. Seager, 21650 W. C. Riding, 21894 J. Boffey, 305125 D. S. Doig, 311047 T. D. Smith, 316418 M. McKenzie, 316459 T. Pritchard, 324083 J. Duncan, 337183 G. A. Brown, 337636 J. A. Hutt, 339144 S. Hancock, 341544 W. H. Day, 344127 J. Scott, 344141 P. H. Burrows, 344156 A. E. Wright, 344171 E. G Barber.

As Clerks.

21277 E. Bantock, 23148 B. C. Watson, 101890 N. Crabtree, 104091 J. W. Killen, 106393 D. H. Walker, 35636 G. Carter, 42377 L. C. Piper, 56145 L. Quin, 63377 A. W. Clare, 65513 H. Capon, 70050 F. Fish, 71589 H. Richards, 75539 C. W. Noble, 76419 E. D. Rees, 79216 W. J. Jones, 88123 W. Chalmers, 90368 H. G. Watkins, 92580 H. Wilson, 93900 R. Marshall, 97849 E. C. N. Batten, 114041 A. Gordon, 115346 W. Moss, 301544 J. McL. Scott, 318357 C. Mabbett, 344165 S. C. Goldstone, 344195 S. W. Thomas, 350316 H. Miller, 450453 J. McIver, 354436 J. Spalding, 366413 A. E. Brain, 390262 G. W. Readymartcher, 393326 W. M. Maughan, 401418 L. King, 405443 L. V. Harrison, 410043 W. B. Hughes, 426101 H. Jackson, 442365 T. Davy, 859385 C. G. Bowditch, 473351 C. D. Selsby, 497514 T. E. Henderson, 512189, J. Burbidge, 533030 H. J. Smith, 536475 P. E. Munro, 21864 N. F. Perrin, 103350 T. Hoyle, 105040 H. Waterworth, 32080 R. Fox, 38762 J. Hayes, 52514 A. L. Johns, 57345 T. P. O'Shea, 64259 J. H. Railton, 69380 R. S. Burgess, 70110 S. Taylor, 72281 F. J. Evans, 75912 A. E. Oliver, 76698 H. Appleby, 80921 L. Nunn, 88654 N. W. Smith, 91153 J. E. Vick, 92737 W. R. M. Dennis, 97364 H. J. Williams, 113891 F. Southgate, 114933 A. E. Russell, 119410 W. Prim, 303428 W. Hay, 318538 T. Burleigh, 344168 L. Stott, 344197 W. W. Vann, 350168 J. B. Marsden, 350351 S. Williams, 354022 G. Snowden, 368369 F. S. Richards, 393344 J. R. Stoddart, 401356 F. Reece, 403087 C. E. Crook, 405503 C. R. Pacy, 410097 C. F. Walkland, 433104 J. A. Ollis, 442417 L. Brooks, 467132 L. P. Humby, 481089 F. H. G. Webb, 497597 W. Aspden, 512217 P. Sperrin, 534580 S. Giddings, 536497 A. G. Clarkson. 350182 R. Johnson, 350376 J. Phizacklea, 22447 R. Conoley, 101785 J. Higginson, 103804 C. W. Fletcher, 106353 J. Scotter, 33008 H. L. Bryan, 40236 L. Totterdell, 53278 H. E. Sanson, 57946 E. H. Smith, 64976 T. W. Owbridge, 69627 A. Lancashire, 70218 W. G. Young, 75268 L. Long, 76102 G. G. Seconde, 76895 H. Sullock, 88066 G. P. Ransome, 89243 J. A. Melrose, 92326 E. G. Rushrook, 93238 W. Holden, 97384 W. Pugh, 113905 G. Pearce, 114987 E. O. Pike, 121332 W. Robinson, 318316 R. J. Mackie, 339619 F. Ball, 344191 H. T. Parker, 344207 F. P. Ellis, 354435 T. A. Bannister, 366339 C. H. Wheeler, 388581 T. W. Scott, 393317 W. P. Ferguson, 401297 F. H. Heckingbottom, 401363 A. J. Naylor, 403471 J. A. Lord, 408089 H. A. Joplin, 421208 A. L. Lamb, 435439 F. Bayman, 446042 F. Hurst, 467148 J. G. Theasby, 495396 A. E. Diwell, 500264 F. S. Paine, 536177 W. G. Thompson, 538491 H. Bubbers, 541207 G. Rapley, 541201 H. W. Stanbridge.

As Cooks.

33258 W. D. Malcolm, 92787 J. T. Palmer, 352426 J. Spencer, 390447 W. Liversedge, 58009 H. Rudd, 103407 W. Colvin, 375054 W. J. Palmer, 459429 T. H. Salter, 92736 G. A. Day, 103634 H. Gordon, 390250 F. C. Lees, 465068 C. H. Hoskins, 499147 W. Taylor, 515036 R. W. Dawkins.

These advancements are subject to the conditions laid down in paragraph 35 Standing Orders for the R.A.M.C., 1914.

CANCELLATIONS.—CORPS ORDERS.

Advancement of Privates.—Corps Pay.

The advancement to the 3rd rate of corps pay of 52889 Pte. P. F. Gibbs, dated September 14, 1917, is hereby cancelled.

The advancement to the 4th rate of corps pay of 25850 Pte. A. B. Balchin, 32491 Pte. A. J. Taulbut, and 104030 Pte. W. H. Lord, dated January 24, 1918, is hereby cancelled.

DISTINGUISHED CONDUCT MEDALS.

His Majesty the King has been pleased to award the Distinguished Conduct Medal to the undermentioned for gallantry and distinguished service in the Field :—

(Supplement to the *London Gazette*, dated February 18, 1918.)

39741 Pte. J. Gallimore.

For conspicuous gallantry and devotion to duty. He showed great courage and self-sacrifice in attending to the wounded under heavy fire.

(Supplement to the *London Gazette*, dated March, 4, 1918.)

40508 Serjt. T. Ashmore, M.M.

For conspicuous gallantry and devotion to duty in charge of bearers. He led three parties of stretcher-bearers through heavy shell fire to clear R.A.P.s. He was wounded in the arm while bringing in a wounded man, and later on gassed, but continued to perform his duties until ordered to withdraw.

27821 Serjt. A. Blandford, M.M.

For conspicuous gallantry and devotion to duty during a heavy bombardment of gas and H.E. shells. He led a party of stretcher-bearers to the rescue of some gunners whose dug-outs had been blown in. At great personal risk they succeeded in digging them out and rescued three alive. It was due to his initiative, courage and energy that three lives were saved.

37128 Cpl. (Acting Serjt.) A. C. Cardy, M.M.
For conspicuous gallantry and devotion to duty while in charge of forward bearers. He superintended the evacuation of the wounded under continuous heavy fire and over almost impassable ground, remaining at his work until all the wounded were cleared, although wounded himself.

1998 Serjt. E. Patrick, M.M.
For conspicuous gallantry and devotion to duty in charge of a relief post for three days. He worked without ceasing, collecting and evacuating wounded under heavy shell fire, and so saved the lives of many men.

32509 Pte. (Acting Serjt.) R. G. Wardrop, M.M.
For conspicuous gallantry and devotion to duty when in charge of a bearer post. He got all the wounded away from his post under intense shell fire, and in spite of casualties among the bearers, working in the open with utter disregard of danger. He set a magnificent example of courage and untiring energy.

39168 Staff-Serjt. O. Williams.
For conspicuous gallantry and devotion to duty when a dug-out at a forward post was blown in during an action. He was the first on the spot, assisting to extricate the wounded under very heavy shell fire. When both the officers at the post were wounded he took command, controlling the evacuation of the wounded with great skill. His coolness and disregard of self were a stirring example.

4977 Pte. (Acting Serjt.) W. Wilson.
For conspicuous gallantry and devotion to duty. When casualties were caused at a position which was subjected to a heavy bombardment he at once organized a party of bearers, hastened to the spot, and succeeded in rescuing a wounded officer under heavy fire. Later, he rendered most valuable service in helping to rescue two men who had been buried in a dug-out. On many occasions he displayed great courage and coolness of a high order.
(Supplement to the *London Gazette*, dated March 28, 1918.)

23139 Pte. W. D. Jones.
For conspicuous gallantry and devotion to duty. He was one of a party of eight bearers attached to a battalion which at the time was being subjected to heavy shell fire. Though the other bearers had separated and sought shelter, he went from cellar to cellar looking for wounded and reporting their location to the Medical Officer. Later, on three occasions during the intense bombardment, he went out and brought in a wounded case on his back. Throughout the whole period he displayed exceptional courage, and as a result of his initiative, untiring efforts and splendid example, a large number of wounded were collected and rapidly evacuated.

20784 Pt. W. Kelsall.
For conspicuous gallantry and devotion to duty. Owing to there being a heavy barrage on the road to the advanced dressing station, all communications with the Motor Ambulance unit were cut off. He volunteered to proceed to the advanced dressing station and inquire what assistance was required. Having returned through the barrage, he personally conducted seven ambulances along this road, thus enabling twenty-eight stretcher cases to be evacuated. During the following twenty-four hours he twice returned to the advanced dressing station, and on a later occasion, when proceeding along this road, was wounded. As a result of his zeal, devotion to duty, and complete disregard for personal safety, a large number of wounded were rapidly evacuated.

100629 Pte. W. Young.
For conspicuous gallantry and devotion to duty. As medical orderly attached to a tank battalion, though blown up and wounded he performed his duties with the utmost coolness, attending to infantry wounded cases as well as those of his own battalion. He accomplished fine work in helping to extinguish the burning clothing of two men. Throughout he displayed the greatest devotion to duty and an entire disregard of personal safety.

12743 Qmr.-Serjt. (Temp. Serjt.-Major), T. R. Wilson.
For conspicuous gallantry and devotion to duty. When the enemy attacked he organized the clearing of a dressing station and saved a large number of wounded from falling into the enemy's hands. While the position was subjected to heavy shell and machine-gun fire and the enemy were approaching from several directions, he remained at his post, searching for and removing the wounded. He was partly responsible for getting an ambulance train full of wounded away, and helped to save the personnel and transport of the dressing station. He showed magnificent coolness and initiative in a critical situation.

With reference to the award of Distinguished Conduct Medals, dated March 7, 1918, the following are the acts of gallantry for which the decorations have been awarded.

(Supplement to the *London Gazette*, dated April 17, 1918).

25789 Serjt. H. Bottomley.

For conspicuous gallantry and devotion to duty. His sympathetic care and treatment of the sick and wounded, and his magnificent work in the field on many occasions when in charge of stretcher-bearers collecting wounded, often under heavy fire, have been of inestimable value.

6146 Pte. (Acting Serjt.) J. Hughes.

For conspicuous gallantry and devotion to duty as senior N.C.O. bearer since the commencement of the campaign. His great courage and powers of leadership and his brilliant work have been of the very greatest value throughout.

18576 Qmr.-Serjt. (Acting Serjt.-Major) W. Lamkin.

For conspicuous gallantry and devotion to duty as senior N.C.O. of a bearer division and of advanced dressing stations. The courage, initiative, and enthusiasm which he has always displayed in his work, and his magnificent example of cheerfulness in danger, have been of the utmost value throughout the campaign.

18216 Qmr.-Serjt. (Acting Serjt.-Major) R. G. Leggett.

For conspicuous gallantry and devotion to duty. His courage and energy were admirable, and his splendid example set a high standard of efficiency to all with him.

35078 Staff-Serjt. (Acting Serjt.-Major) T. McNicol.

For conspicuous gallantry and devotion to duty on many occasions during operations. He always exhibited the greatest courage and coolness in supervising the evacuation of the wounded, frequently under heavy shell fire, and his splendid example was an inspiration to his men.

20788 Cpl. (Acting-Serjt.) J. Moran.

For conspicuous gallantry and devotion to duty on many occasions. Owing to his courage and coolness under shell fire, the wounded were always quickly removed out of danger, and his magnificent example greatly inspired the bearers working under him.

54483 Serjt. W. Price.

For conspicuous gallantry and devotion to duty during operations. He has been in charge of stretcher-bearers for a long period, and always displayed great courage and initiative in collecting and evacuating the wounded. He set a magnificent example to all with him.

Military Medals.

His Majesty the King has been graciously pleased to confer the Military Medal for Bravery in the Field to the undermentioned Warrant Officers, Non-commissioned Officers and Men:—

(Supplement to the *London Gazette*, dated February 23, 1918.)

45514 Pte. A. C. Amey.
33703 Pte. C. J. Ashman.
35408 Pte. A. Bagshaw.
40729 Pte. (Acting Cpl.) W. Baseley.
7594 Pte. W. H. Beake.
49069 Pte. H. Bland.
74626 Pte. W. Bridgford.
61603 Pte. J. Cooper.
35791 Cpl. A. Davies.
58054 Pte. E. M. Davies.
4604 Pte. B. Dempster.
31842 Pte. C. Farrell.
7265 Pte. J. C. Finigan.
20294 Pte. W. Fish.
44672 Pte. M. Gaffney.
30808 Pte. J. Grierson.
37016 Pte. A. Hall.
64877 Pte. A. Hamilton.
66607 Pte. F. Hamlin.
56484 Pte. (Acting Lance-Cpl.) J. Hancock.
52295 Serjt. H. E. Hardy.
45772 Pte. J. C. Harradine.
103741 Pte. H. Haslam.
18344 Pte. (Acting Serjt.) A. Hayden.
80445 Pte. W. H. Heath.
50426 Pte. G. Henson.
56668 Pte. J. Hughes.
8980 Pte. W. Kelly.
106059 Pte. F. R. Kennerley.
36049 Serjt. A. Killan.
7838 Pte. J. McEwen.
53896 Pte. T. Muir.
714 Pte. (Acting Cpl.) W. Parry.
81113 Pte. A. Petrie.
42062 Serjt. (Acting Serjt.-Major) W. J. Post.
39642 Pte. H. C. Prescott.
3061 Pte. S. Price.
38401 Lance-Cpl. W. Purves.
68333 Pte. F. M. Rackham.
91687 Pte. S. R. J. Rattey.
20551 Pte. M. Reed.
33170 Pte. W. H. Reid.
78760 Pte. T. Richardson.
74364 Pte. G. V. Snell.
29234 Pte. E. Spencer.
43171 Pte. W. E. Strickland.
64087 Cpl. (Acting Serjt.) A. Swindall.
2368 Pte. L. Symons.
58470 Pte. (Acting Serjt.) C. F. M. Taylor.
73611 Pte. E. Taylor.
37650 Lance-Cpl. J. W. Taylor.
46510 Serjt. G. B. Trim.
45389 Pte. (Acting Cpl.) L. O. Walford.
3782 Pte. (Acting Lance-Cpl.) J. R. Wells.
55005 Pte. W. J. Whittaker.
30345 Pte. A. H. Williams.
90134 Serjt. A. M. Wilson.
20514 Pte. J. H. Woodward.

(Supplement to the *London Gazette*, dated March 13, 1918.)

89018 Pte. E. Airey.
45507 Pte. A. Ansell.
90014 Pte. E. Bell.
47037 Qmr.-Serjt. (Acting Serjt.-Major) H. C. Bell.
74767 Pte. W. E. Bennellick.
22667 Pte. L. Birkby.
6474 Pte. E. C. Bishop.
33747 Pte. (Acting Serjt.) G. S. Blow.
74440 Pte. E. C. Callard.
41206 Lance-Cpl. S. J. Clarke.
19731 Pte. A. Clements.
47223 Pte. A. Clifton.
71908 Pte. J. Cowan.
5313 Pte. A. W. Crowther.
16979 Serjt. (Acting Staff-Serjt.) R. V. V. Egan.
55285 Serjt. R. Fallowfield.
53352 Pte. D. Farnan.
61974 Pte. D. Fielder.
25133 Pte. J. Fielding.
71655 Pte. (Acting Cpl.) W. H. Folley.
9607 Cpl. J. Fowler.
71816 Lance-Cpl. C. E. Francis.
78920 Pte. T. H. Gibson.
32209 Pte. W. Guthrie.
39891 Pte. H. J. Harding.
47431 Pte. H. Heath.
71954 Pte. H. Hewson.
76127 Pte. W. Holden.
75076 Pte. J. H. Holdsworth.
4712 Pte. W. C. Holloway.
34680 Pte. (Acting Serjt.) G. E. Hughes.
69566 Pte. W. E. Jackson.
69320 Pte. J. Kehoe.
51292 Serjt. W. C. A. Laing.
9680 Pte. A. Larking.
75141 Pte. W. Laws.
47522 Pte. D. Lochray.
45453 Pte. J. Masters.
41183 Pte. J. E. Mitchell.
47040 Staff-Serjt. D. Moffatt.
64558 Pte. A. D. Murray.
75030 Pte. J. Newman.
90698 Pte. F. G. Paul.
46538 Pte. (Acting Cpl.) D. Philip.
3134 Pte. A. Pirie.
39680 Serjt. E. A. Rees.
54889 Cpl. A. E. Reese.
75014 Pte. A. Rogerson.
6726 Cpl. (Acting Serjt.) W. S. Salter.
54658 Pte. J. Savage.
47468 Pte. W. Short.
73193 Pte. (Acting Lance-Cpl.) J. T. Smith.
53120 Pte. R. W. Southard.
64670 Pte. (Acting Cpl.) J. H. Stewart.
54325 Pte. R. Strickland.
11636 Pte. J. Supple.
3137 Pte. A. C. Swan.
38000 Pte. J. G. Thompson.
66583 Pte. A. B. Turner.
18886 Pte. P. Walsh.
90005 Pte. W. Warren.
64481 Pte. (Acting Lance-Cpl.) A. J. Watts.
71968 Pte. (Acting Cpl.) P. G. Williams.
64066 Pte. (Acting Cpl.) J. C. Wood.

(Supplement to the *London Gazette*, dated March 19, 1918.)

88239 Pte. A. Anderson.
5995 Pte. (Acting Serjt.) A. B. Barsby.
70135 Pte. J. A. Bebelman.
1703 Pte. W. Breeds.
30784 Pte. J. H. Bridge.
20038 Pte. A. J. Brockman.
103662 Pte. C. E. Buzan.
80401 Pte. C. H. Cooper.
68490 Pte. H. Cunliffe.
33542 Serjt. S. A. Fitch.
47854 Pte. S. Golding.
2298 Pte. J. Greene.
32620 Cpl. E. J. Ireson.
23832 Pte. J. G. Moore.
115 Pte. (Acting Lance-Cpl.) H. T. Murrell.
42250 Pte. E. Newman.
37163 Pte. M. O'Shea.
62948 Pte. (Acting Lance-Cpl.) J. Petrie.
8154 Pte. L. Stones.
44893 Pte. H. Walker.
47519 Pte. W. H. Wood.

(Supplement to the *London Gazette*, dated April 2, 1918.)

30825 Pte. C. Bull.
101731 Pte. G. Glaze.
102037 Pte. A. C. Goodwin.

(Supplement to the *London Gazette*, dated April 10, 1918.)

223 Serjt. (Acting Staff-Serjt.) W. Peake.
21835 Pte. W. N. Hobday.

(Supplement to the *London Gazette*, dated April 25, 1918.)

38112 Pte. A. Coad.
32763 Pte. J. W. Flower.
65201 Pte. F. B. Hands.
38161 Pte. G. F. Harris.
37479 Pte. W. Jackson.
68445 Pte. J. B. Jones.
37475 Pte. H. S. Lilley.
37546 Pte. C. W. Linscott.
92903 Pte. A. J. G. Mackie.
90768 Pte. H. E. McIlroy.

BAR TO MILITARY MEDALS.

His Majesty the King has been graciously pleased to approve of the award of a Bar to the Military Medal to the undermentioned Non-commissioned Officers and Men :—

(Supplement to the *London Gazette*, dated February 23, 1918.)

42093 Pte. (Acting Lance-Cpl.) E. J. Trim. (M.M. gazetted August 23, 1916.)
57417 Serjt. J. McL. Donald. (M.M. gazetted November 16, 1916.)
6434 Cpl. (Acting Lance-Serjt.) T. Waterman, D.C.M. (M.M. gazetted December 9, 1916).
65457 Cpl. (Acting Serjt.) B. W. Gunn. (M.M. gazetted June 18, 1917.)
46951 Cpl. H. Scandrett. (M.M. gazetted July 9, 1917.)
38024 Cpl. (Acting Serjt.) C. E. Brooker. (M.M. gazetted July 18, 1917).
57780 Serjt. T. Wood. (M.M. gazetted March 12, 1917.)
70884 Pte. W. Booth. (M.M. gazetted December 17, 1917.)

(Supplement to the *London Gazette*, dated March 13, 1918.)

66354 Pte. (Acting Serjt.) H. W. Dutton. (M.M. gazetted February 19, 1917.)
47455 Pte. L. J. Fulljames. (M.M. gazetted June 18, 1917.)

(Supplement to the *London Gazette*, dated March 19, 1918.)

669 Cpl. (Acting Serjt.) T. A. Marlborough, D.C.M. (M.M. gazetted August 10, 1916.)
47639 Pte. J. Limer. (M.M. gazetted November 2, 1917.)

(Supplement to the *London Gazette*, dated April 10, 1918.)

58097 Pte. (Acting Staff-Serjt.) A. J. Tait. (M.M. gazetted December 9, 1916.)

Meritorious Service Medals.

His Majesty the King has been graciously pleased to approve of the award of the Meritorious Service Medal to the undermentioned Man for gallantry in the performance of Military duty:—

(Supplement to the *London Gazette*, dated December 17. 1917.)

1748 Pte. M. Doyle.

His Majesty the King has been graciously pleased to award the Meritorious Service Medal to the undermentioned Warrant Officers, Non-Commissioned Officers and Men, in recognition of valuable services rendered with the Armies in the Field during the present War:—

(Supplement to the *London Gazette*, dated March 13, 1918.)

60208 Pte. (Acting Lance-Serjt.) G. W. Beach.
17759 Qmr.-Serjt. (Temp. Serjt.-Major) J. Black.
11236 Serjt. B. A. Embein.
5049 Pte. A. Kellett.
18656 Staff.-Serjt. (Acting Serjt.-Major) H. G. Maywood.

Honours and Rewards.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for Distinguished Services rendered during the course of the Campaign.

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

Decoration and Medal conferred by His Majesty the King of Serbia.

(Supplement to the *London Gazette*, dated October 3, 1917.)

Silver Medal.

101928 Pte. W. Blackett. | 74917 C. Brewer. | 26029 W. B. Whitbread.

Decoration and Medal conferred by His Majesty the King of Italy.

(Supplement to the *London Gazette*, dated March 25, 1918.)

Silver Medal for Military Valour.

106120 Pte. F. France.

Decoration conferred by His Majesty the King of the Belgians.

(Supplement to the *London Gazette*, dated April 15, 1918.)

Décoration Militaire.

19007 Staff-Serjt. (Acting Qmr.-Serjt.) J. R. Dare | 7705 Pte S. A. Phillips.

Decoration and Medal presented by the President of the French Republic.

(Supplement to the *London Gazette*, dated April 18, 1918).

Croix de Guerre.

12261 Qmr.-Serjt. (Acting Serjt.-Major) J. E. Green. | 63640 Pte. H. C. Buckham.

The King has been graciously pleased to award the Decoration of the Albert Medal in Gold to 49809 Pte. (Acting Lance-Cpl.), J. Collins, Royal Army Medical Corps, in recognition of his gallant action in saving life in the following circumstances:—

On November 11, 1917, near an advanced dressing station in France a lunatic soldier escaped from his escort and ran away along a trench. Collins ran after him, and when he got near him the man threatened to throw a bomb at him. Collins closed with the man, who then withdrew the pin from the bomb and let it fall in the trench. In an endeavour to save the patient and

two other soldiers who were near, Collins put his foot upon the bomb, which exploded killing the lunatic and injuring Collins severely, fortunately the two soldiers were not hurt. Collins, who could easily have got out of the way, ran the gravest risk of losing his life in order to save others.

(The *London Gazette*, No. 30453, dated January 1, 1918.)

The King has been graciously pleased to confer the Decoration of the Albert Medal upon 70270 Pte. S. A. Bodsworth, Royal Army Medical Corps.

The following is an account of the services in respect of which the decoration has been conferred:—

On April 10, 1917, His Majesty's hospital ship "Salta" was sunk in Havre Roads. His Majesty's ship "Druid" proceeded to render assistance, and got alongside a swamped boat of the "Salta." All the occupants of the boat were rescued except a hospital Sister and Pte. Bodsworth. The former was so exhausted that she was unable to hold the ropes thrown to her, and eventually became unconscious. Although he might have been rescued Pte. Bodsworth persisted in remaining in the boat with the sister, and, after she had fallen overboard and had been hauled back again, he finally succeeded in placing a line round her body, by means of which she was hauled on board the "Druid." Very considerable risk was incurred by Pte. Bodsworth in rendering the service on account of the rough sea which prevailed at the time.

(The *London Gazette*, No. 30472, dated January 11, 1918.)

MENTIONED IN DISPATCHES.

The names of the following Non-Commissioned Officers and Men were mentioned in the Dispatch from Major-Gen. A. R. Hoskins, C.M.G., D.S.O., late Commander-in-Chief, East African Force:—

(Supplement to the *London Gazette*, dated March 7, 1918).

50899 Cpl. (Acting Serjt.) F. Bray.
36708 Pte. J. Brockless.
6893 Pte. A. Chubb.
60272 Pte. J. O. Gray.
36717 Pte. E. Iredale.
36719 Pte. W. Jackson.
1643 Serjt. (Acting Staff-Serjt.) F. H. Mattock.
1375 Serjt. H. Shipton.
36729 Pte. J. Sidebottom.
19792 Staff-Serjt. H. A. Baigent.
19634 Cpl. J. E. Kelliher.
670 Pte. C. M. Bergin.
12588 Staff-Serjt. J. Meason.
63131 Pte. H. Birchall.
68999 Pte. E. Ainscow.
54514 Pte. P. A. Mudd.
4569 Serjt. L. Richardson.

The names of the following Warrant Officers, Non-Commissioned Officers and Men were mentionedin the Dispatch from Lieut.-Gen. Sir Stanley Maude, K.C.B., Commanding-in-Chief, Mesopotamia Expeditionary Force:—

(Supplement to the *London Gazette*, dated March 12, 1918.)

75963 Pte. G. Ambler.
34007 Qmr.-Serjt. G. C. Bester.
35737 Cpl. J. B. Brown.
16317 Pte. S. Davenport.
97906 Pte. (Acting Lance-Cpl.) W. Drummond.
27348 Serjt. W. Greenwood.
954 Serjt. H. C. Hallett.
23542 Serjt. A. E. Hughes.
14926 Serjt.-Major W. H. G. Hunt.
4435 Pte. J. G. Hunter.
32621 Pte. (Acting Serjt.) A. Johnson.
25648 Serjt. J. H. Jones.
24351 Pte. W. P. Kelly.
12002 Staff-Serjt. (Acting Serjt.-Major) W. J. Knee.
69958 Serjt. (Acting Staff-Serjt.) H. Latter.
17857 Qmr.-Serjt. (Acting Serjt.-Major) A. E. Macklen.
751 Staff-Serjt. (Acting Qmr.-Serjt.) A. J. Milne.
76141 Pte. J. E. Price.
97911 Pte. J. Rudd.
24681 Serjt. (Acting Staff-Serjt.) W. Smith.
35559 Pte. (Acting Serjt.) E. G. Tilt.
70345 Pte. W. H. Wheele.

The names of the following Warrant Officer, Non-commissioned Officers and Men of the Royal Army Medical Corps were mentioned in the dispatch from Field-Marshal Sir Douglas Haig, K.T., G.C.B., G.C.V.O., K.C.I.E., Commander-in-Chief of the British Armies in France, published in the Supplement to the *London Gazette*, dated May 25, 1918:—

77055 Serjt. G. W. Ames.
19336 Cpl. (Acting Staff-Serjt.) A. Barnes.
13338 Serjt.-Major H. S. Boxshall.
42527 Pte. (Acting Cpl.) R. H. Bradbury.
71956 Pte. (Acting Serjt.) J. W. Briggs.
16756 Staff-Serjt. (Acting Qmr.-Serjt.) N. W. Brown.
40423 Pte. (Acting Serjt.) F. J. Burgess.
62700 Serjt. F. E. Buxton.
18061 Staff-Serjt. (Acting Serjt.-Major) W. Cairns.
48925 Pte. (Acting Cpl.) A. E. Channing.
48097 Pte. A. Chave.
61883 Cpl. (Acting Serjt.) E. G. Clegg.
38125 Cpl. (Acting Serjt.) A. C. Darbyshire.
65323 Pte. (Acting Serjt.) D. T. Davidson.
27943 Pte. A. Dickinson.
53674 Cpl. (Acting Qmr.-Serjt.) H. Duke.
90487 Pte. (Acting Cpl.) S. A. Dyer.
77071 Pte. (Acting Serjt.) H. Evans.
19688 Staff-Serjt. (Acting Serjt.-Major) T. V. Falkingham.

15312 Serjt. G. Gillespie.
54843 Cpl. R. B. Graham.
71738 Pte. T. Hacking.
89674 Pte. J. Hadfield.
17212 Pte. (Acting Cpl.) F. Haskell.
90454 Staff-Serjt. A. Hay.
63912 Serjt. (Acting Staff-Serjt.) D. Jeffreys.
48311 Serjt. G. J. Jones.
54078 Serjt. (Acting Qmr. Serjt.) W. Keighley.
54640 Serjt. (Acting Qmr.-Serjt.) H. Kirwan.
1659 Pte. (Acting Cpl.) J. Loram (M.M.).
17632 Qmr.-Serjt. H. C. A. Lunn.
45969 Serjt. G. Mackay.
32950 Pte. T. McWhannel.
54443 Serjt. H. Mellor.
16397 Staff-Serjt. W. G. Mills.
46711 Pte. J. Monaghan.
640 Pte. A. Nixon.
2278 Pte. I. Parker.
75280 Serjt. S. R. Paskin.
19126 Serjt. (Acting Serjt.-Major) F. H. Perkins.
10031 Pte. W. Penman.
32964 Serjt. (Acting Staff-Serjt.) F. E. Preston.
41193 Pte. J. Rainey.
59112 Pte. (Acting Cpl.) L. Richards.
69111 Pte. (Acting Cpl.) M. H. Rowe.
37022 Cpl. J. Simpson.
76432 Cpl. (Acting Lance-Serjt.) W. C. Smith.
8861 Serjt. E. Steffens.
5731 Pte. (Acting Cpl.) T. Thorne.
2276 Pte. (Acting Cpl.) D. Torrance.
35182 Pte. H. Stansfield.
15967 Serjt. W. T. Tringham.
58655 Cpl. F. Turner.
5134 Serjt. A. Vaughan.
72533 Pte. (Acting Lance-Cpl.) F. A. Watson.
90437 Pte. (Acting Lance-Cpl.) J. E. Williams.
12185 Staff-Serjt. (Acting Qmr.-Serjt.) A. S. Willis.

BROUGHT TO NOTICE.

The names of the undermentioned Warrant Officers, Non-commissioned Officers and Men, Royal Army Medical Corps, have been brought to the notice of the Secretary of State for War for valuable services rendered in connexion with the War:—

(War Office, March 13, 1918.)

26183 Serjt. (Acting Staff-Serjt.) F. Wills.
1848 Staff-Serjt. (Acting Serjt.-Major) A. V. Martins.
2242 Cpl. J. Thomson.
50225 Pte. (Acting Cpl.) H. Ackroyd.
14461 Serjt.-Major A. Baker.
26 Serjt. (Acting Qmr.-Serjt.) F. Bax.
58577 Staff-Serjt. (Acting Serjt.-Major) W. A. Browne.
15671 Qmr.-Serjt. (Acting Qmr.) R. M. Cole.
50965 Pte. A. Davis.
5171 Serjt. (Acting Serjt.-Major) W. E. L. Eason.
18613 Temp. Serjt.-Major C. F. Grant.
44987 Serjt. (Acting Qmr.) J. W. Griffiths.
15183 Qmr.-Serjt. (Acting Serjt.-Major) A. V. Heggie.
19867 Pte. (Acting Serjt.) W. S. Hughes.
53243 Serjt. (Acting Serjt.-Major) W. King.
12058 Serjt.-Major A. W. Pettley.
44071 Serjt. (Acting Serjt.-Major) H. Randall.
52898 Pte. (Acting Serjt.) T. Scott.
43081 Pte. (Acting Serjt.) A. A. Smith.
12582 Serjt.-Major J. Whiting.

PROMOTIONS.

The following promotions to complete War Establishment will take effect from the dates specified:—

To be Quartermaster-Serjeants.

Dated February 21, 1918.—20698 Staff-Serjt. G. Rothwell, 17022 Staff-Serjt. A. R. Weaver.
Dated April 2, 1918.—17542 Staff-Serjt. R. Colgan.
Dated April 26, 1918.—11741 Staff-Serjt. H. Hudson.
Dated May 1, 1918.—17521 Staff-Serjt. H. G. Parsons.

To be Staff-Serjeants.

Dated February 21, 1918.—73 Serjt. F. Ellard, 1051 Serjt. W. H. Davey.
Dated March 8, 1918.—1974 Serjt. C. D. Ferguson (M.M.).
Dated April 2, 1918.—1919 Serjt. F. H. Vyse.
Dated April 6, 1918.—1302 Serjt. J. Jack.
Dated April 26, 1918.—1344 Serjt. W. C. Shelley.
Dated May 1, 1918.—1475 Serjt. W. J. Bamford.

To be Serjeants.

Dated February 21, 1918.—20672 Cpl. S. Whitehead, 17557 Cpl. J. F. Starie.
Dated February 25, 1918.—19591 Cpl. P. L. Rolfe.
Dated March 8, 1918.—2029 Cpl. F. Robinson (M.M.), 4451 Cpl. C. K. Davis.
Dated March 24, 1918.—4684 Cpl. J. McEnaney.
Dated March 26, 1918.—4738 Cpl. G. L. Dell.
Dated March 27, 1918.—4870 Cpl. S. Poules, 4863 Cpl. H. G. Haines.
Dated April 2, 1918.—4879 Cpl. C. W. Barlow.
Dated April 6, 1918.—4898 Cpl. W. H. Wicken.
Dated April 26, 1918.—4917 Cpl. J. A. Chilcott.
Dated May 1, 1918.—4942 Cpl. A. McCombie.
Dated May 3, 1918.—7407 Cpl. C. Rich.
Dated May 23, 1918.—21 Cpl. T. Keech.
Dated May 24, 1918.—1483 Cpl. C. Licence.

To be Corporals.

Dated February 15, 1918.—12536 Pte. B. Bethell, 2484 Pte. W. A. Last.
Dated February 20, 1918.—17277 Pte. R. N. Knowles.
Dated February 21, 1918.—18020 Pte. C. A. Barnes, 2690 Pte. W. H. Hamer.
Dated February 25, 1918.—4152 Pte. P. Wild.
Dated February 27, 1918.—19101 Pte. W. Flaxman, 19103 Pte. H. G. Noble, 6507 Pte. F. Robinson, 4185 Pte. B. Cuffley.
Dated March 2, 1918.—5632 Pte. W. P. Barsby, 19296 Pte. E. T. J. Owen.
Dated March 8, 1918.—4977 Pte. W. Wilson (D.C.M.).
(In accordance with Corps Order No. 17 of this date.)
Dated March 8, 1918.—19818 Pte. J. G. Deakin.
Dated March 23, 1918.—18996 Pte. A. Biggs.
Dated March 24, 1918.—128 Pte. G. Stephens.
Dated March 26, 1918.—1642 Pte. E. Jordan.
Dated March 27, 1918.—20589 Pte. W. J. Davis.
Dated April 2, 1918.—20784 Pte. W. Kelsall (D.C.M.).
(In accordance with Corps Order No. 17 of this date.)
Dated April 6, 1918.—12156 Pte. W. Matchin.
Dated April 10, 1918.—960 Pte. P. H. Higgins.
Dated April 21, 1918.—988 Pte. E. Lord.
Dated April 22, 1918.—20702 Pte. H. Dunn.
Dated April 23, 1918.—20796 Pte. H. Greenwood.
Dated April 26, 1918.—20151 Pte. E. Jones.
Dated May 1, 1918.—6417 Pte. R. B. Evans.
Dated May 3, 1918.—20014 Pte. J. R. Latus.
Dated May 23, 1918.—7353 Pte. C. A. G. Harris.

These promotions are subject to the conditions laid down in paragraph 35, Standing Orders for the Royal Army Medical Corps, 1914.

Temporary Promotions.

The following temporary promotions, to complete War Establishment, will take effect from the date specified :—

To be Temporary Serjeant-Majors.

Dated March 16, 1918.—Quartermaster-Serjeants : 16058 S. M. Gawthorne, 18415 A. Bell, 11807 J. Levey, 14770 A. Buckner, 15544 E. J. Barnes, 17633 R. Sproule (M.M.), 15843 W. Stokes, 16205 T. Gregson, 16569 E. Attfield, 14326 W. P. S. Morman, 18453 F. A. Philbrook, 17748 C. H. Dissent, 18216 R. G. Leggett (D.C.M.), 18976 E. G. Robinson, 18337 C. Leaker, 18432 G. F. Pearce, 18445 J. E. Crawley, 17928 W. S. Toye, 18385 F. W. Coupland, 18645 C. E. Rouse, 12461 P. F. Cook, 15288 W. C. Prince (M.M.), 15591 J. Harris, 15813 A. V. Heggie, 18948 E. Moore, 15671 R. W. Cole, 15483 E. Sharp, 17057 M. Ward, 17736 J. D. Keeble, 18969 E. Gray, 13032 T. Kerr, 12989 E. G. W. Barnes, 16678 J. E. March, 11614 W. H. Howard, 18222 A. Dady, 14761 W. Robertson, 12819 W. H. Riches, 17573 C. Harlen, 13035 G. V. Chandler, 17358 C. Ennor, 12709 H. J. Ford, 17091 J. Moore, 19320 H. A. Richie (M.M.), 103 G. P. Steer, 12065 A. A. E. McKnight.

These temporary promotions are subject to the conditions laid down in paragraph 35 Standing Orders for the Royal Army Medical Corps, 1914.

Queen Alexandra's Imperial Military Nursing Service.

The undermentioned Non-commissioned Officers have been selected for admission to Q.A.I.N.S., with increased pay at sixpence (6d.) a day in accordance with Article 861, Royal Warrant for pay, from the date specified :—

Dated February 18, 1918.—4890 Cpl. J. Tumilty vice Staff-Serjt. F. J. R. Baiden.
Dated March 25, 1918.—1072 Serjt. H. A. French vice Staff-Serjt. H. A. Baigent.

Nursing Section.

The following appointments to the Nursing Section of the Corps will take effect from tne dates specified :—

Dated January 14, 1918.—12696 Pte. D. C. H. Knight.
Dated January 15, 1918.—7748 Pte. F. Hall.
Dated January 22, 1918.—20010 Pte. J. McDermott, 3125 Pte. A. J. Trimby, 1880 Pte. C. R. Seitz.
Dated February 2, 1918.—2373 Pte. C. C. Hope, 20183 Pte. W. Taylor, 2508 Pte. D. Douglas.
Dated February 26, 1918.—322 Pte. J. Donnelly.
Dated February 28, 1918.—12567 Pte. R. B. Wiles.
Dated March 9, 1918.—4088 Pte. C. A. Banyard, 7617 Pte. C. A. F. Dunglison.
Dated March 13, 1918.—2603 Pte. G. Oldham, 3184 Pte. J. T. Morris.
Dated March 20, 1918.—6194 Pte. G. R. Powell, 11255 Pte. W. Reece, 259 Pte. S. Magill.
Dated March 22, 1918.—7725 Pte. H. Watts.
Dated March 23, 1918.—10331 Pte. C. S. Waters, 10172 Pte. H. O'Neill.

Dated March 30, 1918.—3509 Pte. D. Boomer, 6725 Pte. S. Bowers.
Dated April 9, 1918.—3937 Pte. W. J. Wilkins.
Dated April 22, 1918.—19204 Pte. G. Kell, 3363 Pte. A. S. Bird, 1846 Pte. G. R. Lawson, 870 Pte. P. McGrail.
Dated April 26, 1918.—728 Pte. J. Brown.
Dated May 11, 1918.—343 Pte. P. Garry, 6085 Pte. G. Cousins, 2470 Pte. F. Buckingham.
Dated May 17, 1918.—5326 Pte. W. Smith, 5624 Pte. E. C. Stachini.

ADVANCEMENT OF PRIVATES—CORPS PAY.

The following advancement in rate of Corps Pay will take effect from June 1, 1918 :—

To be Advanced to the Third Rate (at 8d.).
As Orderlies.

6076 J. Winterton, 3408 G. Sheils, 10117 J. Elliott, 7348 R. H. Warrell, 4639 F. Beesley, 5615 A. G. Cook, 4576 R Davies, 4388 D. P. Humphris, 8757 F. A. Noon, 10120 W. J. Bradfield, 7686 T. Hasell, 5279 E. F. Millgate, 6014 W. Clark, 657 F. T. Bone, 2251 B. H. Cooke.

To be Advanced to the Fourth Rate (at 6d.).
As Orderlies.

11246 G. Nicholson, 7646 G. A. Jordan, 7462 J. G. McNab, 4768 E. Wright, 20400 J. C. Gray, 5101 A. L. Murray, 860 A. H. Mills, 1676 F. Goodge, 1811 R. H. Grant, 1829 J. J. Oxley, 20118 R. Hunt, 12614 H. A. Whitby, 1638 S. Faulkner, 2657 D. Doyle, 12645 H. Sallows, 1377 G. Taylor, 7602 W. Vaughan, 20403 P. Boulton, 12443 W. H. Hall, 20049 F. Bailey, 12615 D. MacDougall, 4785 J. Lancaster, 2077 T. H. Messer, 4618 O. C. Dormon, 1785 A. W. Keen, 11265 G. Smith, 11270 J. H. Tonks, 11903 C. Thomas, 1717 M. Brady, 11374 R. Duckett.

These advancements are subject to the conditions laid down in paragraph 35 Standing Orders, for the Royal Army Medical Corps, 1914.

SANITARY ORDERLIES.

The following Private is advanced to the Fourth Rate of Corps Pay at 6d. as Sanitary Orderly from the date specified .—
Dated March 25, 1918.—4634 Pte. H. Green.

BUGLERS.

The undermentioned boys are appointed Buglers from May 24, 1918, inclusive :—
12722 G. H. Vickers, 12729 T. J. Daly.

REPOSTING TO CORPS.

The undermentioned Non-commissioned Officer rejoined the Corps from the date specified :—
Dated May 9, 1918.—15776 Qmr.-Serjt. H. G. Blackman, from Colonial Government.

PROMOTION CANCELLED.

The promotion to the rank of Corporal of 1999 Pte. A. P. Pullen, dated March 7, 1918, is hereby cancelled.

ARMY MEDICAL OFFICERS' WIDOWS AND ORPHANS FUND.

SUMMARY OF THE PROCEEDINGS OF A QUARTERLY MEETING OF THE COMMITTEE HELD AT THE ROYAL ARMY MEDICAL COLLEGE ON JULY 15, 1918.

Present :—

Deputy Surg.-Gen. W. G. Don, Vice-President, in the Chair.
Surg.-Gen. W. S. M. Price, Vice-President.
Surg.-Gen. Sir H. R. Whitehead, K.C.B.
Major-Gen. J. J. Gerrard, C.B.
Col. Sir W. B. Leishman, K.C.M.G., C.B., F.R.S., K.H.P.
Lieut.-Col. G. S. Mansfield.
Major W. C. Smales, D.S.O.

(1) The Minutes of the Meeting of April 15, 1918, were read and confirmed.

(2) The deaths of the following members were reported : Major E. L. McSheehy, died May 1, Surg.-Gen. C. Hervé Girand, died May 10, and their widows were placed on the list of annuitants each receiving the gratuity at the £200 rate.

(3) The Secretary reported that £2,500 out of cash surplus had been invested in 5 per cent National War Bonds 1928, as authorized at the last meeting.

(4) The Secretary reported that sixty-nine officers had been gazetted to Regular Commissions in the Corps on June 1, 1918, and that a notice had been sent to each of them explaining the benefits offered by the Society and the terms of membership. Under a resolution passed at the

last meeting these officers are eligible fer married membership at the present extra war charge in addition to the normal annual subscription, but as this resolution only covered the period up to the date of the present meeting it was proposed by Sir Hayward Whitehead, seconded by Sir William Leishman, and carried unanimously:—

"That such officers as may be gazetted to Regular Commissions in the Corps up to the date of the next following meeting of the Committee be eligible for admission as married members of this Society at the present extra war charge of 25 guineas per annum, in addition to the normal annual subscription as laid down in the Rules. Also, that all Regular officers of the Corps may be admitted as unmarried members at the annual subscription of £2; provided that if any such unmarried member who has joined the Society since the outbreak of war be transferred to the married list before it ends, he shall be liable for any additional war charge which may be in force for married members at the time of his marriage."

(5) With reference to the appointment of a Consulting Actuary in the place of the late Mr. Andras, the Secretary reported the results of the inquiry which he had made, and submitted a letter from the Hon. Treasurer, Sir James McGrigor, strongly recommending the appointment of Mr. R. R. Tilt, Actuary to the General Reversionary and Investment Company. No other recommendations were made by members. After consideration it was proposed from the chair and carried unanimously that Mr. Tilt be asked if he will accept the appointment on the same terms as those on which the late Mr. Andras held it, viz.—a fee of 50 guineas for the quinquennial valuations and an annual fee of 10 guineas for advice on such questions as may from time to time arise.

(5A) It was then proposed by Sir William Leishman, seconded by Lieut.-Col. Mansfield and carried unanimously:—

"That if Mr. Tilt accept the appointment he be asked to report to the next meeting of the Committee as to whether it be possible to reduce the present extra war charge."

(6) A Trustee's receipt for payment having been made by the Secretary of his annual premium to the Guarantee Society was submitted.

(7) Payment of the Secretary's salary, office allowance and refund of petty cash expended for the quarter ended June 30 was sanctioned, and also of the printer's account, £11 5s.

NOTICE.

This Fund provides annuities of £50 a year during widowhood, to the widow of the marriage during which the subscription of a married member began. In the event of the death of the widow this annuity is continued to the children of such marriage until the youngest attain the age of 21 years. It also continues for their benefit, up to the same age, if the widow re-marries. Furthermore, should the wife of the subscriber predecease him, it will be optional for him to continue the subscription he had been paying as a married member, in order to provide an annuity similar to the above for the children of the marriage, until the youngest shall have attained the age of 21 years.

Provision is also made whereby a part of the surplus at any quinquennial valuation may be applied for the benefit of members, or their wives, or orphan children. Thus, by the appropriations of surplus at the valuations of December 31, 1910 and 1915, the prospective widows of first-class married members on the books at those dates, will receive, during this current quinquennium, £200 and £100 respectively at the death of their husbands, their annuities being also increased to the statutory limit of £52.

Examples of the rates of annual subscriptions are:—

Husband's age	Wife's age	Annual subscription
25	20	£13 8 5
30	27	£14 6 1
36	33	£16 17 2
46	40	£22 12 6
50	45	£24 9 5

The present extra war charge, which is subject to revision, is 25 guineas per annum, in addition to the normal annual subscription according to scale. Only Regular officers are eligible for membership.

Unmarried officers may become members by paying £2 yearly, and can thus reduce the rate of their subscriptions when married.

The Secretary will be glad to give any further information as to details.

J. T. Clapham,
Captain,
Secretary.

3, *Homefield Road*,
Wimbledon, *S.W.* 19.

ROYAL ARMY MEDICAL CORPS COMFORTS AND PRISONERS OF WAR FUND.

THE following is a fourth list of contribution from companies and units at home and abroad to our Prisoners of War Fund received up to the end of July, and I am requested by the Ladies' Committee to convey their most cordial thanks to all ranks for their continued support. The number of our prisoners unfortunately does not decrease, the total being now considerably over 800, and the cost of each parcel has increased to 10s., so it is hoped that all units may keep our requirements in mind and send us subscriptions as circumstances permit.

A monthly grant from Regimental Institutes would be most acceptable whatever the amount.

It should be noted that although it has been found more convenient for business reasons not to change the name of the Fund, the whole of the money received is expended *on prisoners of war only* and that no part of it goes to "comforts" for units in the field.

It is regretted that space does not admit of the individual subscriptions of officers and other friends being recorded, but they are most gratefully accepted and acknowledged separately by the Honorary Secretary.

E. M. WILSON,
Hon. Treasurer.

FOURTH LIST.

LIST OF COMPANIES AND UNITS AT HOME AND ABROAD CONTRIBUTIONS TO PRISONERS OF WAR FUND IN 1918.

	£	s.	d.
May 14.			
No. 10 Field Ambulance (additional)	£5	0	0
40th Sanitary Section	2	15	0
13th Motor Ambulance Convoy	8	12	6
51st General Hospital	29	8	8
2nd Western General Hospital ..	2	10	0
25th Sanitary Section	5	8	0
R.A.M.C. Jamaica European and Native	5	0	0
28th General Hospital, Salonica	64	12	2
28th General Hospital, Salonica, Nursing Staff	16	6	10
63rd General Hospital	71	9	2
101st Field Ambulance	10	10	0
R.A.M.C. Officers' School of Instruction, Blackpool	46	7	0
35th Field Ambulance (additional)	1	0	0
47th Sanitary Section	1	0	0
Saint Ignatius Hospital, Malta	13	15	0
40th Stationary Hospital, Officers and other ranks	8	5	0
No. 18 General Hospital, Chicago, U.S.A.	39	8	4
98th Field Ambulance	6	0	0
53rd Field Ambulance ..500 fr.			
3rd Training Battalion, Blackpool	5	0	0
5th Reserve Battalion, Scottish Rifles	2	0	0
6th Cavalry Field Ambulance 260 fr.	9	11	6
R.A.M.C. Detachment, Tigne, Malta	15	0	0
No. 2 Field Ambulance, B.E.F., France	26	8	0
87th First West Lancs Field Ambulance .. .. ..872 fr.			
88th 1st East Anglian Field Ambulance	7	7	4
89th 1st West Riding Field Ambulance .. .. ..395 fr.			
1/2nd West Riding Field Ambulance	2	0	0
2nd Canadian General Hospital (1,200 fr.)	44	0	0
96th Field Ambulance	£32	0	0
14th Field Ambulance	15	16	0
No. 12 Ambulance Train ..	12	0	0
47th General Hospital (additional)	6	12	0
No. 11 Casualty Clearing Station	27	0	0
No. 20 Casualty Clearing Station	5	0	0
62nd Field Ambulance	14	14	8
May 23.			
B Company 6th Training Battalion, Blackpool	2	10	7
1/3rd South Midland Field Ambulance	4	0	0
110th Field Ambulance ..	10	0	0
35th Company, Millbank ..	10	0	0
57th Field Ambulance	10	0	0
The Duchess of Westminster Hospital	2	0	0
62nd Casualty Clearing Station	25	16	4
No. 6 Casualty Clearing Station	41	13	0
No. 8 Stationary Hospital ..	57	10	8
No. 16 General Hospital (Philadelphia, U.S.A.)	3	11	2
51st Highland Casualty Clearing Station	20	0	0
58th Casualty Clearing Station	22	1	0
49th General Hospital, Salonica	10	0	0
60th General Hospital, Salonica	6	0	0
42nd Ambulance Train	2	10	0
No. 40th Casualty Clearing Station	4	0	0
Crpl. A. E. Ramsdale: Sale of Poem	6	10	0
R.A.M.C. School of Instruction, Blackpool (2nd contribution)	53	5	3
Late Crookham Training Centre	100	0	0
52nd General Hospital, Salonica	10	0	0
98th Field Ambulance	45	6	9
16th Company, R.A.M.C., Cork	2	19	6
72nd Sanitary Section	1	4	0
135th Field Ambulance	19	9	0
7th Training Battalion Blackpool	9	12	0
Military Hospital, Ghain Tuffieha, Malta	20	12	3
2nd Western General Hospital, Manchester	5	0	0

58th Field Ambulance	£6	0	0
June 4.			
61st General Hospital	5	5	0
Headquarters 75th Division. E.E.F.	2	0	0
2nd, 3rd, 4th, and 5th Ambulance Flotillas	1	18	0
52nd Field Ambulance (500 fr.)			
No. 8 Convalescent Depot, Salonica	50	0	0
No. 25 General Hospital	28	12	0
Serjeants' Mess, 3rd Loyal North Lancashire Regiment	10	11	0
Imtarfa Military Hospital, Malta	10	0	0
51st Field Ambulance (500 fr.)			
18th Company Rochester Row	20	0	0
19th Company, Chester	30	0	0
49th General Hospital	10	0	0
27th Ambulance Train	10	0	0
1st Training Battalion, Blackpool	5	0	0
June 7.			
14th Convalescent Depot (Officers)	18	18	0
44th Casualty Clearing Station	6	7	0
147th Field Ambulance, Cairo	35	8	6
12th Stationary Hospital	16	10	0
Military Hospital, Prospect, Bermuda	2	0	0
43rd Casualty Clearing Station	39	0	0
38th General Hospital, Salonica	25	0	0
95th Field Ambulance (Officers)	7	6	0
33rd Advance Depot Medical Stores, Warrant and N.C.O.s and men	2	15	0
61st Field Ambulance	22	0	0
55th Casualty Clearing Station	4	0	0
38th Field Ambulance	16	16	0
No 2 Stationary Hospital	9	8	6
1/2nd South Midland Field Ambulance (T.F.)	10	0	0
32nd Stationary Hospital (1225.25 fr.)			
No. 20th Stationary Hospital Officers and Men	29	10	0
Military Hospital, Maryhill, Glasgow	50	0	0
35th Company, R.A.M.C., London	10	0	0
Military Hospital, Prees Heath, Shropshire, Officers' Mess	5	5	0
June 14.			
Medical Officers' Chester War Hospital	9	3	0
53rd General Hospital	5	1	3
139th Field Ambulance	15	0	0
2/3rd East Lancs Field Ambulance (2nd contribution)	18	8	4
14th Battalion Tank Corps	18	15	0
12th Corps R.A.M.C. Officers, Wt. and N.C.O.s and Men	108	1	6
72nd General Hospital Serjeants' Mess (150 fr.)			
No. 12 Base Depot Medical Stores, Salonica	2	8	3
Citadel Hospital, Cairo, Serjeants' Mess	5	0	0
R.A.M.C. Detachment, Perham Down, Salisbury	3	0	0
165th Combined Field Ambulance	4	10	0
4th Training Battalion, Blackpool	7	0	0
June 21.			
77th Field Ambulance	30	0	0
3rd Training Battalion, Blackpool	£5	0	0
3rd Training Battalion, Blackpool, C and D Company	1	1	9
3rd Northern General Hospital Orderly Room	1	10	0
2/1st Highland Field Ambulance Anti Blues Concert	9	0	0
Staff of S.M.O. Barfleur, Officers, N.C.O.s and Men	26	15	9
Regimental Institutes, Netley	25	0	0
No. 20 Motor Ambulance Convoy	7	7	0
June 25.			
30th Division B.E.F., France	50	0	0
The Medical Society of 59th Division	11	11	0
72nd Sanitary Section	1	5	0
64th Field Ambulance	39	17	0
R.A.M.C. School of Instruction (Officers), Blackpool	16	15	6
37th General Hospital	36	15	0
40th British General Hospital, Mesopotamia	75	4	11
R.A.M.C. Detachment, St. Helena	1	1	0
2nd, 3rd, 4th, and 5th Ambulance Flotillas (2nd donation)	3	6	8
47th General Hospital, Salonica	10	0	0
Officers' 64th Field Ambulance (further donation)	16	0	0
No. 15 Sanitary Section	3	0	0
41st General Hospital, Salonica	6	0	0
Lord Mayor of Liverpool's Shilling Fund	100	0	0
4th Southern General Hospital	23	2	0
2/3rd East Lancs Field Ambulance (3rd donation)	10	0	0
July 5.			
Officers and men 2/5th London Field Ambulance	15	10	0
19th Company R.A.M.C., Chester (further donation)	20	0	0
12th St. Louis, U.S.A., General Hospital (2nd donation)	10	0	0
71st General Hospital, Cairo (1,300 piastres)			
7th Training Battalion, R.A.M.C., Blackpool (further contribution)	15	5	1
Disembarkation Staff, Dover	17	14	10
8th Training Battalion, Blackpool	5	0	0
July 19.			
22nd Field Ambulance	33	7	0
R.A.M.C. Detachment, Bermuda	1	5	0
2/2nd North Midland Field Ambulance (further contribution)	7	6	0
Ambulance Barges No. 105 and 106	2	6	6
140th Field Ambulance	5	0	0
Pavilion General Hospital, Brighton	4	4	0
2/1st Highland Field Ambulance (T.F.)	11	0	0
133rd British General Hospital, Mesopotamia	10	0	0
Officers of the Connaught Hospital	16	2	0

	£	s.	d.
Military Hospital, Gosport (two donations)	£1	19	9
Military Hospital, Blandford ..	25	0	0
Military Hospital, Blandford, Officers	5	0	0
Matron and Nursing Staff 133rd British General Hospital ..	2	2	5
4th General Hospital Tennis Tournament	10	10	0
July 19.			
44th Casualty Clearing Station (135.50 fr.)			
76th Casualty Clearing Station	£12	13	0
4thTraining Battalion,Blackpool	7	16	2
3rdTraining Battalion,Blackpool	6	9	0
38th Ambulance Train	6	12	0
July 25.			
16th General Hospital, Philadelphia, U.S.A. (2nd donation)..	18	7	0
146th Field Ambulance	22	9	4
4th Stationary Hospital (60 fr.)	2	4	3
3rd Loyal North Lancs Regiment, per Col. L. P. Maynard	102	6	0

"REVEILLE."

The demand for the first number of the new Government quarterly review *Reveille* was so great that the first impression was exhausted a few days after publication, and many people were, consequently, unable to obtain their copies. The second impression, however, is now ready and the review can be obtained from H.M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, or through any bookseller.

OBITUARY.

The announcement of the sudden death of Major-Gen. W. G. Birrell through illness contracted on service is full of sadness to many of those who knew him throughout the thirty-seven years he spent on the active list. A sturdy Scot, his compact figure, fair complexion and kindly blue eye will remain in memory.

In private life his love of Scotland, of his rod and his gun were perhaps his outstanding characteristics. Always able and clear-headed, no officer had a higher sense of duty—for no labour deterred him, no rebuff dismayed him, if thereby he could carry through what he believed to be right and best for the well-being of the Army and for the care of the sick and wounded.

Born in 1859, Gen. Birrell was educated at the Academy and graduated at the University of Edinburgh. He joined the Service in 1881, served in the Sudan in 1885, again in Burma in 1886-7, in the Nile Campaign in 1898, and in the present War occupied the position of Director of Medical Services of the Mediterranean Expeditionary Force during the earlier operations in Gallipoli.

On his return to England he was appointed Deputy Director Medical Services of the Southern Command, an office of much labour and great difficulty in which he earned the just praise of his Commander-in-Chief. He continued to occupy this appointment until compelled to retire by ill-health a few months ago, and it cannot be doubted that his premature death was due to his self-sacrificing exertions.

His sturdy character, his strong opinions and his innate reticence sometimes obscured his worth and did not always find favour; so he left the Service, to which he had devoted his whole strength and his working life, without any of those honorific distinctions that a more facile disposition would most certainly have made his. But his memory will not suffer on that account in the hearts and minds of those who knew aright this loyal officer and kindly Scottish gentleman.

DEATH.

WARD.—At Aldershot, on August 30, 1918, Major William Alfred Ward, R.A.M.C., aged 50 years.

EXCHANGES, &c.

A free issue of twenty-five reprints will be made to contributors of Original Communications, and of twenty-five excerpts of Lectures, Travels and Proceedings of the United Services Medical Society.

Any demand for reprints, additional to the above, or for excerpts, must be forwarded at the time of submission of the article for publication, and will be charged for at the following rates, and additional copies at proportionate rates:—

Number of Reprints	Number of Pages	Cost of Reprints	Cost of EXCERPTS*	Extra for Covers for Reprints			
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	4	0 2 9	0 1 2				
12	8	0 5 0	0 2 3	4 3	1 1	3 10	0 9
	16	0 8 3	0 3 11				
	4	0 3 4	0 1 5				
25	8	0 6 0	0 2 9	4 10	1 6	4 4	0 11
	16	0 10 6	0 5 0				
	4	0 4 6	0 1 10				
50	8	0 7 6	0 3 6	6 0	2 1	4 10	1 2
	16	0 13 3	0 5 10				
	4	0 6 0	0 3 1				
100	8	0 10 0	0 4 10	7 10	3 11	6 7	2 5
	16	0 18 6	0 7 6				
	4	0 9 6	0 4 5				
200	8	0 15 0	0 6 7	10 10	7 6	9 0	4 10
	16	1 6 0	0 9 8				

* These are not arranged as Reprints, but appear precisely as in the Journal with any other matter that may happen to appear on the first and last pages of the particular excerpt ordered.

Cases for Binding Volumes.—Strong and useful cases for binding can be obtained from the publishers at the undermentioned rates :—

Covers, 2s. 6d. net; binding, 2s. 6d.

These charges are exclusive of cost of postage.

In forwarding parts for binding the name and address of sender should be enclosed in parcel.

The above figures are subject to 25 per cent increase.

All Applications for Advertisements to be made to—

G. STREET & CO., Ltd., 8, Serle Street, London, W.C.

The back outside cover is not available for advertisements.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are inserted free of charge to subscribers and members of the Corps. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS," 324, Adastral House, Victoria Embankment, E.C. 4.

The following publications have been received:—

British: The Medical Review, The Medical Journal of South Africa, The Medical Press, Proceedings of the Royal Society of Medicine, Journal of Tropical Medicine and Hygiene, Surgery, Gynæcology and Obstetrics, Guy's Hospital Gazette, St. Bartholomew's Hospital Journal, Tropical Diseases Bulletin, The Practitioner, The Middlesex Hospital Journal, The Hospital, Edinburgh Medical Journal, Transactions of the Society of Tropical Medicine and Hygiene.

Foreign: Bulletin of the Johns Hopkins Hospital, Rivista de la Sauidad Militar, Lyon Chirurgical, Office International d'Hygiène Publique, Archives de Médecine et Pharmacie Navales, Giornale di Medicina Militare, American Journal of Care for Cripples, United States Public Health Service, The Military Surgeon, The Journal of Infectious Diseases.

MANAGER'S NOTICES.

The JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is published monthly, six months constituting one volume, a volume commencing on 1st July and 1st January of each year.

The Annual Subscription is £1 (which includes postage), and should commence either on 1st July or 1st January; but if a subscriber wishes to commence at any other month he may do so by paying for the odd months between 1st July and 1st January at the rate of 1s. 8d. (one shilling and eightpence) per copy. (All subscriptions are payable in advance.)

Single copies can be obtained at the rate of 2s. per copy.

The Corps News is also issued separately from the Journal, and can be subscribed for at the rate of 2s. (two shillings) per annum, including postage. Subscriptions should commence from 1st July each year; but if intending subscribers wish to commence from any other month, they may do so by paying for the odd months at the rate of 2d. per copy. (All subscriptions are payable in advance.)

Officers of the Royal Army Medical Corps possessing Diplomas in Public Health, etc., are kindly requested to register their special qualifications at the War Office. Letters of complaint are frequently received from officers stating that their special qualifications have not been shown in the Distribution List which is published as a supplement to the Journal in April and October of each year. As, however, the particulars of this list are supplied from official sources, officers are reminded that unless the possession of Diplomas, etc., has been registered at the War Office, no entry of such qualifications can be recorded in the Distribution List.

Letters notifying change of address should be sent to the Hon. Manager, "Journal of the Royal Army Medical Corps," 25, Adastral House, Victoria Embankment, E.C. 4, and must reach there not later than the 20th of each month for the alteration to be made for the following month's issue.

It is requested that all Cheques or Postal Orders for Subscriptions to the Journal, Corps News, Reprints, etc., be crossed "Holt & Co.," and made payable to the "Hon. Manager, Journal R.A.M.C.," and not to any individual personally.

All communications for the Hon. Manager regarding subscriptions, etc., should be addressed to

THE HON. MANAGER,
"JOURNAL OF THE ROYAL ARMY MEDICAL CORPS,"
25, ADASTRAL HOUSE, VICTORIA EMBANKMENT, E.C.4.

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

October, 1918.

EXTRACTS FROM THE "LONDON GAZETTE."

War Office,
September 12, 1918.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for distinguished services rendered during the course of the campaign:—

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

Decorations and Medals conferred by His Majesty the King of Italy.

Order of the Crown of Italy.

Bronze Medal for Military Valour.

20720 Pte. William Alfred Boyes, Royal Army Medical Corps (Special Reserve), (St. Helens, Lancashire).

437381 Pte. (Acting Cpl.) William Harold Chick, Royal Army Medical Corps (Birmingham).

Italian Bronze Medal, "della Salute Publica."

Capt. John James Harkness Beckton, Royal Army Medical Corps.

Order of St. Maurice and St. Lazarus.

Cavalier: Major George William Webb Ware, D.S.O., M.B., Royal Army Medical Corps.

Order of the Crown of Italy.

Officer: Col. Robert Wallace Wright, C.M.G., Royal Army Medical Corps.

September 13, 1918.

His Majesty the King has been graciously pleased to approve of the award of a Bar to the Military Medal to the undermentioned Non-commissioned Officers and Men:—

461233 Lance-Cpl. A. Goddard, M.M., Royal Army Medical Corps (Gosport).

65716 Pte. (Acting Cpl.) W. Clouston, M.M., Royal Army Medical Corps (Caterham Valley).

405267 Pte. (Acting Lance-Cpl.) H. Carter, M.M., Royal Army Medical Corps (Sheffield). (M.M. gazetted February 23, 1918.)

M1/06774 (Acting Cpl.) J. H. Weatherley, M.M., Army Service Corps (M.T.), attd. Royal Army Medical Corps (Barnes). (M.M. gazetted July 16, 1918.)

His Majesty the King has been graciously pleased to approve of the award of the Military Medal for bravery in the Field to the undermentioned Non-commissioned Officers and Men:—

Royal Army Medical Corps.

403582 Pte. (Acting Lance-Cpl.) D. Arnold (Woodhouse, Leeds).
56630 Pte. J. Barnes (Ealing).
433076 Pte. F. B. Beale (Moreton-in-Marsh)
89036 Pte. L. Bell (Ashington).
32025 Pte. G. Beresford (Walsall).
403163 Pte. R. E. Bolton (Leeds).
405272 Pte. (Acting Lance-Cpl.) W. Briggs (Sheffield).

46014 Pte. C. Brookling (Treharris).
40493 Pte. J. Carter (Eastleigh).
42430 Pte. (Acting Cpl.) G. Cartwright (Flixton).
316236 Pte. G. Corlett (Glasgow).
71849 Pte. C. S. Cox (Burnley).
401039 Serjt. A. Daniels (Newsam, nr. Leeds).
405019 Pte. (Acting Lance-Cpl.) F. Dent (Sheffield).
401391 Pte. A. Dickinson (Leeds).
48666 Pte. E. Douglas (Wrexham).
7763 Pte. J. Farrell (Dublin).
66189 Pte. W. J. Ford (Clutton, nr. Bristol).
40166 Serjt. T. P. Fowler (East Bethnal Green).
534218 Pte. H. E. Freshwater (East Finchley).
72519 Pte. G. C. Gardner (Northampton).
403576 Lance-Serjt. A. Geairns (Wheatbottom, co. Durham).
50403 Pte. (Acting Lance-Cpl.) G. Gilpin (South Shields).
364374 Pte. A. Grahame (Newport, Monmouthshire).
405152 Pte. E. Gregory (Sheffield).
52008 Pte. (Acting Lance-Cpl.) S. A. Grimes (Ipswich).
401024 Pte. T. B. Haley (Leeds).
536311 Pte. (Acting Lance-Cpl.) W. A. Harry (Newport, Monmouthshire).
401090 Cpl. (Acting Lance-Serjt.) P. Harvey (Halifax).
405133 Pte. A. C. Hayward (Sheffield).
403549 Pte. (Acting Lance-Cpl.) H. Hill (Leeds).
405147 Pte. J. H. Jenkinson (Sheffield).
8047 Pte. W. Johnston (Houghton-le-Spring).
403591 Pte. W. Kellett (Leeds).
88389 Pte. A. Law (Glasgow).
330088 Pte. (Acting Cpl.) J. P. Lees, attd. Yorkshire Light Infantry (Aberdeen).
337 Pte. J. Loxley (Glasgow).
53548 Serjt. E. G. Lumgair (Cowdenbeath).
405199 Pte. H. Maris (Sheffield).
42504 Pte. G. A. McLennan (Methil).
866 Pte. D. Murphy (East Liverpool).
53486 Pte. J. W. Partis, (Seaton Delavel).
32479 Pte. (Acting Lance-Cpl.) W. Seaward (Brixham).
433036 Pte. G. C. B. Sidwick (Edgbaston).
102518 Pte. S. Skeat (Tydesley).
73000 Pte. L. Stevenson (Nottingham).
403338 Pte. (Acting Lance-Cpl.) P. R. Todd (Knaresborough).
2213 Pte. (Acting Cpl.) J. J. S. Ward (Richmond).
60418 Pte. B. Whitely (Halifax).

War Office,
September 24, 1918.

His Majesty the King has been graciously pleased to approve of the following awards to the undermentioned Officers and Warrant Officers, in recognition of their gallantry and devotion to duty in the Field:—

AWARDED THE DISTINGUISHED SERVICE ORDER.

Major (Temp. Lieut.-Col.) Albert Richard Henchley, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during an enemy attack. In two days he succeeded in evacuating some 1,500 patients. He got away his personnel and lorries under shell and machine-gun fire, and proceeded to a hospital elsewhere from which he evacuated 300 wounded by ambulance trains. His unit was the last to leave the town. His coolness and resource were the means of saving a large number of wounded from falling into the hands of the enemy.

AWARDED A BAR TO THE MILITARY CROSS.

Capt. (Acting Major) Roger Errington, M.C., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during an enemy attack. He remained in his dressing station under machine-gun fire until it was evacuated. He then took another dressing station and again under machine-gun fire evacuated all patients. It was entirely due to his coolness and devotion to duty that these wounded did not fall into the hands of the enemy. (M.C. gazetted January 14, 1916.)

Temp. Capt. Paul MacDonald Little, M.C., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty in attending to wounded in the front line under heavy shell, machine-gun and rifle fire. His example of coolness and devotion to duty caused a large number of wounded to be successfully evacuated from the front line. (M.C. gazetted September 26, 1916.)

Temp. Capt. Alan Cowan Mann, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during an enemy attack. Hearing that a number of wounded had been left in a dressing station, he organized bearer parties and led them through heavy shell fire to the dressing station and evacuated all the wounded. Through his devotion to duty many wounded were cleared who would otherwise have been abandoned. (M.C. gazetted July 26, 1918.)

Capt. (Acting Major) Robert Taylor, M.C., Royal Army Medical Corps (Special Reserve).

For conspicuous gallantry and devotion to duty while in command of an advanced dressing station. He worked with untiring energy, attending to and supervising the loading on to cars of all cases. The dressing station was hit several times, and eventually came under machine-gun fire, but he succeeded in clearing all wounded. He showed fine determination and devotion to duty. (M.C. gazetted August 16, 1917.)

AWARDED THE MILITARY CROSS.

Capt. Alfred Lang Bodley, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. When a dug-out was heavily shelled and blown in he rescued a man from the most dangerous place where three men lay buried, and attended to the men affected, assisting to get them away. In one case he tried for hours to save a man who had lost consciousness, and during this time lost consciousness himself, but continued his work on recovering. His personal example of courage was of the utmost assistance.

Temp. Capt. William Cooper, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty during an enemy attack. He was unremitting in his attention to wounded under fire, and stayed behind in a village with a small salvage party attending to a number of wounded and gassed officers and men who came in. He behaved splendidly.

Temp. Capt. Guy de Hoghton Dawson, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. During an arduous period of retirement, lasting for some days, he worked with unflagging energy in attending to the wounded under heavy fire, evacuating them successfully, on one occasion when the enemy were within 40 yards of the rear aid post. His example helped and encouraged all those under his command.

Capt. (Acting Major) Robert Alfred Greenwood, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in evacuating the wounded. When a bridge was blocked and partly submerged by a fallen tree he supervised the clearing, and helped to carry the wounded across under heavy shell fire on both banks. Though severely shaken by a shell bursting and partially burying him, he carried on until all the wounded were safely across the canal.

Temp. Capt. Norman McAlister Gregg, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty during a raid. He untiringly attended to the wounded under heavy enemy fire until the last man was cleared, and showed great coolness and devotion to duty. He worked persistently throughout the raid in the open, and searched for any wounded that might have been overlooked. He behaved splendidly.

Capt. Henry Taylor Lamb, Royal Army Medical Corps (Special Reserve.)
For conspicuous gallantry and devotion to duty when an outpost company were suffering numerous casualties from enemy bombardment. He proceeded to the locality at once, and under heavy shelling got all the wounded moved to shelter, remaining with the company until the bombardment ceased. During a trying time he showed splendid devotion to duty.

Temp. Capt. William Lumsden, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. While in charge of bearers carrying wounded over an exposed hill-side swept by shell and machine-gun fire he saw a bearer fall. He at once ran to him and dressed his wounds, after which he remained with him until dusk, the man being unable to walk. He then assisted him across country to a place of safety. His conduct was splendid.

Capt. (Acting Major) Kenneth Arly Porterfield Rynd Murray, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in charge of an advanced dressing station during an enemy attack. He worked continuously for two days, often under heavy shell fire, and evacuated over 200 cases. Owing to the constant change of position he had great difficulty in keeping touch with the medical officers of the regiments he was clearing, and only succeeded in doing so by visiting them all personally on several occasions. His courage and magnificent devotion to duty set a fine example to all his men.

Temp. Lieut. Thomas Gordon Playford, M.D., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. Assisted by an orderly, he dressed the wounds of several officers on the roadside under heavy shell fire. Later, he established a dressing station in a village which was rapidly being enveloped by the enemy, and succeeded in clearing all his casualties before it was evacuated.

Lieut. (Acting Major) Raymond Stowers, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in command of an advanced dressing station subjected for hours to heavy shelling. He got all cases away in a most expeditious manner. Subsequently, on the near approach of the enemy, he got his personnel and cars away and opened a temporary dressing station elsewhere, and continued to evacuate wounded till ordered to retire. He showed fine devotion to duty.

Capt. Cecil McLaren West, Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty. On three occasions he went through heavy shell fire to attend casualties in batteries which were under fire, the roads all the time being heavily shelled with high explosives, shrapnel and gas shells.

Capt. (Acting Major) Maurice Ulick Wilson, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty during an attack. He continually attended wounded at the advanced dressing station which was constantly under artillery fire (four shells

dropped within a few yards of the operating table). The work was continued without cessation, so that 247 cases were evacuated in thirty-eight hours. He showed fine devotion to duty under very difficult circumstances.

Canadian Force.

Capt. Christopher Matheson Finlayson, Army Medical Corps.

For conspicuous gallantry and devotion to duty. During a raid on the enemy's positions he worked at the advanced aid post with the greatest gallantry and unselfish courage. Later, he withdrew to the fixed rear aid post and performed valuable duties.

Australian Imperial Force.

Capt. James Iver McIver Chirnside, Army Medical Corps.

For conspicuous gallantry and devotion to duty while attending to wounded men under heavy shell and machine-gun fire. During the retirement of the rearguard squadron he attended to the wounded while the enemy were firing at a distance of 300 yards. He showed great devotion to duty.

Capt. John Eric McGlashan, Army Medical Corps.

For conspicuous gallantry and devotion to duty in charge of the evacuation of wounded during an attack. He visited his various posts under heavy shell and machine-gun fire, and was largely responsible for the successful evacuation of the wounded.

Capt. Hugh Compson Trumble, Army Medical Corps.

For conspicuous gallantry and devotion to duty. Under heavy enemy barrage he pushed forward some 600 yards with his medical personnel to a ledge, where by his capable organization he successfully evacuated quantities of wounded. He worked for three days and nights, and his quiet courage had an excellent effect on wounded and stretcher-bearers alike.

AMENDMENTS.

The following is the correct description of an Officer upon whom a reward has recently been conferred:—

Major (Temp. Lieut.-Col.) R. M. Barron, Indian Medical Service. (*London Gazette*, dated March 26, 1918.)

The following should be added to the announcement in the *London Gazette*, No. 30563, dated March 8, and No. 30856, dated August 22, 1918, against the name of Qmr. and Major G. Merritt, South African Medical Corps: Retired Pay, late Royal Army Medical Corps.

October 3, 1918.

His Majesty the King has been graciously pleased to approve of the award of the Distinguished Conduct Medal to the undermentioned Non-commissioned Officers and Men, for gallantry and distinguished service in the Field:—

390005 Qmr.-Serjt. F. Bell, Royal Army Medical Corps (Hull).

For conspicuous gallantry and devotion to duty when with a party which was carrying twenty wounded men by hand and it was fired on by a party of the enemy which had advanced to about fifty yards from it. With admirable coolness he led his party through houses and then through a forest to a place of safety, and was undoubtedly the cause of saving both personnel and wounded from capture.

9657 Serjt. A. Bradley, Royal Army Medical Corps (Curragh Camp).

For conspicuous good work and devotion to duty. This Non-commissioned Officer led his stretcher parties and safely brought in all wounded under very heavy fire in action.

457394 Pte. E. Clemens, Royal Army Medical Corps (Cardiff).

For conspicuous gallantry and devotion to duty during an enemy attack. He went again and again through heavy shell fire to bring dressings and instruments from a dressing station. For four days he worked without rest, attending to the wounded under very trying conditions, and showed fine devotion to duty.

48703 Pte. J. Davies, Royal Army Medical Corps (Tylorstown, Glamorganshire).

For conspicuous gallantry and devotion to duty. This private was the only European assistant with Lieut. Burnet, R.A.M.C. He acted as his right-hand man, either with stretcher parties or in the dressing station, and remained out all night attending to some wounded who could not be moved till next morning. Later, he was assisting Lieut. Burnet at an amputation when the attack with rifles and machine guns took place on the camp, and, although bullets were traversing the tent, he remained steadily at his post. He has already shown good service and devotion to duty.

457033 Serjt. C. Hancock, Royal Army Medical Corps (Exeter).

For conspicuous gallantry and devotion to duty in a heavy gas shell bombardment of an advanced dressing station which was struck repeatedly by shells. For thirty-six hours he worked under very difficult conditions, attending to the wounded and supervising the evacuation, and thanks to him the evacuation of a great many casualties was rapidly carried out.

38441 Pte. P. Short, Royal Army Medical Corps (South Hylton).

For conspicuous gallantry and devotion to duty. When he was out with a party of stretcher bearers he went to the assistance of a number of wounded, who had collected at a post which was under heavy shell fire, and managed to evacuate them all, though the area was beyond the locality to which his duty would have taken him in his ordinary course. On another occasion when the stretcher squad of another division all became casualties, he and a private went for 300 yards under an intense barrage to the assistance of the wounded, one of whom he gave his box respirator, covering his own mouth with his handkerchief at a great risk of being gassed. His action was a fine example of unselfish devotion to duty and much courage.

386188 Serjt. R. W. Smith, M.M , Royal Army Medical Corps (Gateshead).

For conspicuous gallantry and devotion to duty when from the moment an enemy bombardment started he moved about freely in the open collecting and attending to the wounded. After the advanced dressing station had been evacuated, he made repeated attempts to see if any wounded had been left behind, the road being all the time swept by machine gun and shell fire. For three days this Non-commissioned Officer continued to do the same work, setting a magnificent example of courage and devotion to all who came in contact with him.

25593 Pte. (Acting Cpl.) F. Watts, M.M., Royal Army Medical Corps (Oxford).

For conspicuous gallantry and devotion to duty. This Non-commissioned Officer led a party of stretcher bearers to the rescue of a detachment whose dug-outs had been completely demolished by shell fire. After four hours' hard work, which was carried on under the direct observation of the enemy and a heavy bombardment with high explosives and large calibre shells, he succeeded in rescuing the three survivors, the saving of whose lives was due to his fine initiative, coolness and complete disregard for his own safety.

Australian Imperial Force.

310A Cpl. Eatcock, Australian Army Medical Corps.

For conspicuous gallantry and devotion to duty in carrying and dressing several wounded men, under machine gun and shell fire. At night he went out with a party of stretcher bearers, and personally saw that every wounded man was brought in, going out on several occasions in front of the line and nearly up to the enemy's trenches. All through the action he worked gallantly and rendered distinguished service, going out repeatedly under heavy fire to bring in wounded.

South African Force.

2213 Pte. E. H. Anderson, South African Medical Corps.

For conspicuous gallantry and devotion to duty and coolness under fire when his commanding officer and six others were hit and he himself was suffering from high fever at the time.

6019 Assistant Surgeon A. B. Hamilton, East African Medical Service.

For conspicuous gallantry and devotion to duty. This Warrant Officer has done consistently fine work in every action he has been in. He is invariably sent forward with the bearer parties to relieve the regimental aid stations, and at work of this kind he cannot be surpassed. It has been due largely to his resource and coolness that the wounded have always been safely and quickly transferred from the firing line to the ambulance. He has been so employed in every action, and in two of them was under very heavy fire.

1123 Cpl. E. F. M. Kaschula, South African Medical Corps.

For conspicuous gallantry and devotion to duty. He did continuous good work, which has generally been of a high class, but he did especially well on one occasion when in charge of a post, displaying resource, initiative, and zeal.

2004 Serjt. H. G. Reynolds, South African Medical Corps.

For conspicuous gallantry and devotion to duty. This Non-commissioned Officer has done most excellent work in the past eighteen months in two separate areas. In every action at which he has been present he has set a very high example of coolness under fire, and by his conduct in treating the sick and wounded.

AMENDMENTS.

The following is the correct description of the Non-commissioned Officer to whom the Distinguished Conduct Medal has been recently awarded.

16165 Qmr.-Serjt. (Temp. Serjt.-Major) Bullough, Royal Army Medical Corps, attached South African Medical Corps. (*London Gazette*, August 22, 1918.)

CENTRAL CHANCERY OF THE ORDERS OF KNIGHTHOOD.

St. James's Palace, S.W.

October 4, 1918.

His Majesty the King has been graciously pleased to give orders for the following promotion in and appointment to the Most Excellent Order of the British Empire for services in or for the Oversea Dominions, Colonies and Protectorates, in connexion with the War. The appointment to date from June 3, 1918 :—

DOMINION OF NEW ZEALAND.

To be Officer of the said Most Excellent Order :—

Lieut.-Col. Arthur Stanley Herbert, New Zealand Medical Corps, for special services in connexion with military hospitals at Rotorua.

War Office,
October 7, 1918.

The names of the undermentioned have been brought to the notice of the Secretary of State for War for valuable services rendered in connexion with Military operations in Hedjaz :—

STAFF.

Royal Army Medical Corps.

Major W. McConaghy.
Temp. Capt. W. N. Montgomery, M.B.
106191 Private E. Genner.

The following have been mentioned in dispatches for valuable special services on the Mediterranean Lines of Communication :—

ROYAL ARMY MEDICAL CORPS.

Temp. Capt. M. B. Arnold, M.D.
Capt. B. A. Odlum.
528118 Pte. (Acting Serj.) D. R. Evans.
527858 Pte. (Acting Cpl) F. Fletcher.
528294 Lance-Cpl. E. Hargreaves.
105 Staff-Serjt. F. Newman, D.C.M.
18675 Staff-Serjt. A. C. Partridge.
527134 Staff-Serjt. J. R. Thomas.

ADDITIONAL MENTIONS IN DISPATCHES.

The names of the undermentioned Officers are to be added to those brought to notice for distinguished and gallant services and devotion to duty by Field Marshal Sir Douglas Haig, K.T., G.C.B., G.C.V.O., K.C.I.E., Commander-in-Chief of the British Armies in France, in his dispatch of April 7, 1918. (Published in the Supplements of the *London Gazette*, Nos. 30691, 30693, 30698, 30701, 30704, and 30706, of May, 1918) :—

Lieut. (Temp. Capt.) W. H. Ferguson, Royal Army Medical Corps (Special Reserve).
Temp. Capt. A. C. Mann, M.C., Royal Army Medical Corps, attached S.W. Bord.
Col. R. M. Simpson, Canadian Army Medical Corps.

The names of the undermentioned Officers are to be added to those brought to notice for distinguished and gallant services and devotion to duty by Gen. Sir E. H. H. Allenby, G.C.M.G., K.C.B., Commander-in-Chief of the Egyptian Expeditionary Force, in his dispatch of April 3, 1918. (Published in the Supplement of the *London Gazette* dated June 14, 1918, No. 30746) :—

ROYAL ARMY MEDICAL CORPS.

Temp. Major J. J. Abraham, M.D., F.R.C.S.
Lieut.-Col. (Temp. Col.) G. A. T. Bray.
Major (Temp. Lieut.-Col.) M. Dunning, M.B.
Col. E. G. R. Evatt, M.B.
Capt. (Acting Lieut.-Col.) E. C. Lambkin, M.B.
Temp. Lieut.-Col. H. Wade, M.D., F.R.C.S.

The names of the undermentioned Officers are to be added to those brought to notice for distinguished services by Lieut.-Gen. Sir J. L. Van Deventer, K.C.B., Commander-in-Chief of the British Forces in East Africa, in his dispatch of January 21, 1918. (Published in the Supplement of the *London Gazette* dated August 6, 1918, No. 30829) :—

Lieut.-Col. R. T. Brown, D.S.O., M.B., Royal Army Medical Corps.
Major (Temp. Lieut.-Col.) P. S. Clarke, South African Medical Corps.
Capt. T. S. Dunn, East African Medical Service.
Temp. Major W. J. Gow, Royal Army Medical Corps.
Major R. S. Kennedy, M.C., M.B., Indian Medical Service.
Capt. (Acting Lieut.-Col.) J. A. Manifold, M.B., Royal Army Medical Corps.
Lieut.-Col. P. W. O'Gorman, Indian Medical Service.

The undermentioned Officer has been brought to the notice of the Secretary of State for War for valuable services rendered in connexion with the War :—

Major-Gen. W. G. A. Bedford, C.B., C.M.G., M.B., Army Medical Service.

AMENDMENTS TO MENTIONS IN DISPATCHES.

The undermentioned are now correctly described :—

London Gazette, dated May 25, 1918 (No. 30704).

Temp. Col. H. A. Ballance, Army Medical Service.

Col. (Temp. Major-Gen.) B. M. Skinner, C.B., C.M.G., M.V.O., Army Medical Service, Headquarters Staff.

Lieut.-Col. (Temp. Col.) W. Thorburn, C.B., M.D., F.R.C.S. (Consultants).

Temp. Capt. F. R. Wilson, M.B., Royal Army Medical Corps, attached West Riding Reserves, is substituted for Qmr. and Hon. Capt. F. Wilson, Royal Army Medical Corps.

London Gazette, dated May 28, 1918 (No. 30706).

Major D. M. Embelton, Australian Army Medical Corps (Staff).

London Gazette, dated March 12, 1918 (No. 30570).

Capt. J. Ewing, Royal Army Medical Corps.

London Gazette, dated May 30, 1918 (No. 30711).

Temp. Capt. A. E. Thompson, M.C., M.D., Royal Army Medical Corps.

London Gazette, dated June 11, 1918 (No. 30740).

92433 Pte. W. R. Morris, Royal Army Medical Corps.
81787 Pte. R. R. Williams, Royal Army Medical Corps.

War Office,
October 10, 1918.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for Distinguished Services during the course of the campaign.

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

DECORATIONS CONFERRED BY THE PRESIDENT OF THE FRENCH REPUBLIC.

LÉGION D'HONNEUR.

Croix de Guerre.

Temp. Capt. John Beattie McFarland, M.C., Royal Army Medical Corps.
350049 Sergt. Richard Scowcroft, Royal Army Medical Corps (Bradshaw, near Bolton).

Croix de Chevalier.

Col. Henry Raymond Casgrain, Canadian Army Medical Corps.
Hon. Major Charles Frederick Skipper, Canadian Army Medical Corps.

Croix de Guerre.

Capt. (Acting Major) Edward Richardson Lovell, Royal Army Medical Corps (Special Reserve).
Capt. Mervyn John Holmes, Australian Army Medical Corps.
Major (Acting Lieut.-Col.) Henry Horace Andrews Emerson, D.S.O., M.B., Royal Army Medical Corps.
Capt. Samuel Russell Foster, M.C., M.B., Royal Army Medical Corps.
Major (Temp. Lieut.-Col.) William John Saundry Harvey, D.S.O., Royal Army Medical Corps.
Major (Temp. Lieut.-Col.) Frederick Duke Gwynne Howell, D.S.O., M.C., Royal Army Medical Corps.
Capt. Peter McEwan, M.B., F.R.C.S., Royal Army Medical Corps.
Major (Acting Lieut.-Col.) Philip Janvrin Marett, Royal Army Medical Corps.
Qmr. and Hon. Capt. Robert Daniel Matthews, M.C., Royal Army Medical Corps.
Col. (Temp. Major-Gen.) Samuel Guise Moores, C.B., C.M.G.
Capt. (Acting Major) John James McIntosh Shaw, M.C., M.B., Royal Army Medical Corps, Special Reserve.
Capt. (Acting Major) William Leckie Webster, M.B., Royal Army Medical Corps.
407078 Pte. Edward Francis Exon, Royal Army Medical Corps (Bradford).
10529 Serjt. Edward Selwyn Holmes, Australian Army Medical Corps.
Temp. Capt. Alexander Beck Cluckie, M.B., Royal Army Medical Corps.

DECORATION CONFERRED BY THE PRESIDENT OF THE PORTUGUESE REPUBLIC.

Military Order of Avis, 2nd Class.

Major William Henry Gerard Herbert Best, Royal Army Medical Corps, Special Reserve.

DECORATIONS CONFERRED BY HIS MAJESTY THE KING OF THE HELLENES.

Order of the Redeemer, 2nd Class, Grand Commander.

Surg.-Gen. Sir Hayward Reader Whitehead, K.C.B., F.R.C.S.

Order of the Redeemer, 3rd Class, Commander.

Lieut.-Col. Arthur Russell Aldridge, C.B., C.S.I., C.M.G., M.B. (Reserve of Officers), Royal Army Medical Corps.

Order of the Redeemer, 5th Class, Cavalier.

Captain John Percy Litt, M.D., Royal Army Medical Corps.

Order of the Sacred Treasure, 3rd Class.

Col. Thomas John Rashleigh Lucas, C.B., M.B., retired pay.

DECORATIONS CONFERRED BY HIS MAJESTY THE KING OF SERBIA.

Corrections, London Gazette, September 10, 1918.

The award of the Order of the White Eagle, 4th Class, to Lieut.-Col. Charles Henry Straton, Royal Army Medical Corps, should be amended to read "Order of St. Sava, 4th Class."

War Office,
October 7, 1918.

His Majesty the King has been graciously pleased to approve of the award of a Bar to the Military Medal to the undermentioned Non-commissioned Officers and Men :—

38887 Pte. J. Miller, M.M., Royal Army Medical Corps (Wigan). (M.M. gazetted January 20, 1917.)

1330 Pte. (Acting Lance Cpl.) J. Wilson, M.M., Royal Army Medical Corps (East Southampton).

457355 Cpl. (Acting Lance-Serjt.) G. E. Essex, M.M., Royal Army Medical Corps (Exminster).

337100 Serjt. A. N. Morgan, M.M., Royal Army Medical Corps (Liverpool).

46783 Pte. E. Haynes, M.M., Royal Army Medical Corps (Hunslet).

47173 Pte. E. Davis, M.M., Royal Army Medical Corps (Sidlesham). (M.M. gazetted July 16. 1918.)

His Majesty the King has been graciously pleased to approve of the award of the Military Medal for Bravery in the Field to the undermentioned Non-commissioned Officers and Men :—

ROYAL ARMY MEDICAL CORPS.

45510 Serjt. (Acting Staff-Serjt.) H. W. Abbiss, D.C.M. (Overstrand).
55403 Pte. J. D. Anderson (South Shields).
341242 Pte. R. Bates (St. Helens).
337641 Pte. H. J. Beamer (Liverpool).
390082 Lance-Cpl. R. B. Boynton (Hull).
917 Pte. (Acting Serjt.) A. H. Davis (Roscrea).
341207 Pte. E. Foster (St. Helens).
337056 Pte. G. Fraser (Dewsbury).
337532 Pte. E. Gleave (St. Helens).
8315 Pte. F. Green (Pimlico).
57364 Pte. W. T. Hemming (Birmingham).
12947 Staff-Serjt. (Acting Serjt.-Major) M. Henderson (Belfast).
337728 Pte. H. Heywood (Bolton).
63803 Pte. H. Hilton (Rochdale).
341391 Cpl. G. Hogan (St. Helens).
19855 Pte. (Staff-Serjt.) E. Kerr (Bethnal Green).
101171 Pte. (Acting Serjt.) W. R. Knaggs (Whitby).
1267 Pte. J. W. Lanty (Rotherham).
72528 Pte. W. E. Lowell (Wellingboro').
36594 Pte. P. McElhoney (Lenwood).
473192 Pte. W. P. Meredith (Eastbourne).
102672 Pte. J. Miller (Preston).
421127 Pte. N. Morrell (Wolverhampton).
337320 Pte. P. Morris (Liverpool).
341337 Pte. G. Moss (Southport).
473104 Pte. H. A. Mutimer (Ipswich).
124816 Pte. E. J. Owen (Aberdare).
461392 Serjt. R. N. Parkin (Chester-le-Street).
63565 Pte. C. Pilling (Horwich).
388256 Pte. J. Robson (Cockfield).
426028 Serjt. J. D. Rouse (Leicester).
659 Serjt. L. T. Rousell (Sheffield).
38403 Pte. M. Rowell (Sunderland).
493173 Cpl. S. E. Russell (Snodham).
337596 Pte. J. Sampson (Liverpool).
457386 Pte. R. Selway (Exeter).
341104 Pte. H. Shard (Widnes).
538443 Cpl. R. J. Shepherd (Leytonstone).
457324 Lance-Cpl. J. Slade (Swindon).
303254 Pte. A. Smith (Culter).
28140 Pte. G. A. Stables (Liversedge).
457378 Pte. H. Stocker (Exeter).
20061 Pte. E. Strangeways (Newcastle-on-Tyne).
18253 Qmr.-Serjt. (Acting Serjt.-Major) J. Suter (Dover).
337326 Pte. T. B. Sye (Liverpool).
30321 Pte. A. Thackery (Broughton-in-Furness).
463055 Pte. W. Thorne (Highampton).
103087 Pte. H. H. Towers (Bury).
426003 Staff-Serjt. W. A. Towers (Leicester).
437458 Pte. L. Wilson (Northfield).
4767 Pte. G. Young (Whitburn).

AMENDMENTS.

The following are the correct descriptions of Men whose names have appeared in the *London Gazette* for the award of Military Medals :—

MILITARY MEDALS.

London Gazette dated July 16, 1918.

65313 Pte. W. J. Arnold, Royal Army Medical Corps.

London Gazette dated August 6, 1918.

69809 Pte. (Acting Lance-Cpl.) W. M. Foster, Royal Army Medical Corps.
43754 Pte. T. H. Uncles, Royal Army Medical Corps.
33180 Pte. (Acting Cpl.) F. Walley, Royal Army Medical Corps.

SIR WM. TAYLOR MEMORIAL FUND.

The subscriptions collected from brother Officers and friends of the late Surg.-Gen. Sir William Taylor, K.C.B., amount to £84. The Committee decided that the Memorial should take the form of a Bronze Tablet with suitable inscription. The design was approved and placed in the hands of an artist early in the year. He now reports that he is unable to complete the work owing to the prohibition placed on obtaining the necessary metal. A good site was selected in the chancel at St. George's Church, Aldershot, and permission has been granted by the War Office for its erection. On completion of the Tablet, a small photograph, together with a list of the names of all subscribers will be sent to all subcribers.

Horse Guards Annexe,
12, *Carlton House Terrace, S.W.* 1.
October 1, 1918.

C. R. Tyrrell, *Colonel,*
Hon. Secretary.

ARMY MEDICAL OFFICERS' WIDOWS AND ORPHANS FUND.

NOTICE.

The Committee, with the concurrence of the Actuary, have reduced the extra war premium for married members from twenty-five to fifteen guineas per annum, in addition to the normal annual subscription according to scale. This concession is retrospective.

The extra premium is now payable only when the member proceeds overseas; so long as he is in this country he is charged the tabular premium only.

Unmarried members pay an annual subscription of £2, thereby reducing according to scale the amount of their subscription when they transfer to the married class.

The Secretary will be glad to give any further information as to the Fund.

Summary of the Proceedings of a Meeting of the Committee which was held at the Royal Army Medical College on October 17, 1918.

Present:

Deputy Surg.-Gen. W. G. Don, Vice-President, in the Chair.
Major-Gen. W. S. M. Price, Vice-President.
Major-Gen. Sir H. R. Whitehead, K.C.B.
Lieut.-Col. P. S. O'Reilly, C.M.G.
Lieut.-Col. G. S. Mansfield.

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(1) The Minutes of the Meeting of July 15, 1918, were read and confirmed.

(2) The acceptance of the appointment of Consulting Actuary by Mr. R. R. Tilt, F.I.A. having been reported, the Chairman expressed his pleasure thereat and introduced him to the Meeting.

The Committee considered a Report which, in accordance with a resolution adopted at the last meeting, had been submitted by the Actuary on the question of the reduction of the present extra war charge. The essential points in this Report were:—

(*a*) The Actuary concurred in a modification of the present terms for new entrants, subject to the condition that it remains open to the Committee to increase the charge, and close the Fund, to new entrants at any time during the war, and considered that the extra premium might be reduced from twenty-five to fifteen guineas per annum.

(*b*) He suggested that the extra premium be payable when the member proceeds abroad, charging him the tabular premium only so long as he is in this country.

(*c*) He recommended that if the Committee decide to reduce the extra premium the concession be made retrospective.

Proposed by Major-Gen. Sir H. R. Whitehead, seconded by Major-Gen. Price and carried unanimously, that the Actuary's Report be adopted, and that the recommendations therein be put into effect.

The half-yearly instalment of interest on £124,000 National War Loan five per cent 1929/47 being due on December 1, it was proposed by Major-Gen. Sir H. R. Whitehead, seconded by Lieut.-Col. O'Reilly and carried unanimously, that subject to the approval of the Trustees, on the receipt of this interest, available cash surplus, not exceeding £3,000, be invested in five per cent National War Bonds 1928, and that the Secretary be empowered to take the necessary steps.

(5) On the proposal of Major-Gen. Price, seconded by Lieut.-Col. O'Reilly it was resolved unanimously that such officers as may be gazetted to Regular Commissions in the Corps, up to the date of the meeting of the Committee next following this, be eligible for admission as married members of the Society at the present extra war charge of fifteen guineas per annum.

(6) Payment of annuities to the widows on the list which was submitted was sanctioned.

(7) The death was reported of an annuitant, Mrs. T. B. Moriarity: also of a member, Lieut.-Col. Eugenius A. Roche, whose widow was placed on the list.

(8) Payment of £2 2s. being proportion of fee due to the estate of the late Mr. H. W. Andras, F.I.A., was sanctioned.

(9) Payment of the Secretary's salary for the past quarter was sanctioned, also of office allowance and refund of petty cash expended.

3, Homefield Road,
Wimbledon, S.W. 19.
October 18, 1918.

J. T. Clapham, *Captain*,
Secretary.

ROYAL ARMY MEDICAL CORPS OFFICERS BENEVOLENT SOCIETY.

Minutes of a Committee Meeting held at Adastral House, War Office, on Tuesday, October 15, 1918.

Present:

Major-Gen. Sir W. Donovan, K.C.B., one of the Trustees, in the Chair.
Major-Gen. Sir M. W. Russell, K.C.M.G., Vice-President.
Major-Gen. Sir H. R. Whitehead, K.C.B.
Col. H. W. Murray.
Capt. J. T. Clapham.

(1) The Minutes of the meeting held on July 17 were read and confirmed.

(2) The Secretary reported that as a result of the special appeal made in accordance with the instructions of the Committee Meeting on February 27, 103 subscribers had now joined and 53 other officers had promised to join as from January 1, 1919, making a total of 156—also that the expenses of issuing the appeal had only amounted to £5 14s. 10d.

(3) The Secretary reported that the present cash balance at the bankers was £468 8s. 9d. and it was decided to invest a further sum of £200 in National War Bonds five per cent 1928 issue.

(4) Two cases of special appeal under Rule 24 were considered and it was decided to grant the orphan daughter of A. C. E. £20 for the purpose of starting her in a career, and £20 to the orphan children of K. M. C. in aid of their temporary requirements.

ROYAL ARMY MEDICAL CORPS FUND.

Minutes of a Committee Meeting held at Adastral House, War Office, October 15, 1918.

Present:

Lieut.-Gen. T. H. J. C. Goodwin, C.B., C.M.G., D.S.O., K.H.S., Director-General, in the Chair.
Major-Gen. G. B. Stanistreet, C.B., C.M.G., Deputy Director-General.
Major-Gen. Sir W. Donovan, K.C.B.
Col. C. R. Tyrrell, C.B.
Major E. Offord.
Capt. E. B. Allnutt, M.C., Band President.

(1) The Minutes of the last meeting held on July 17 were read and confirmed.

(2) A letter of regret for non-attendance was read from Col. Sir J. Magill.

(3) The replies received from Senior Officers to the circular letter sent out under the instructions of the Committee at the Meeting held on July 17 relating to the Memorial to certain distinguished officers were read and considered, and it was proposed by Col. C. R. Tyrrell and seconded by Major-Gen. Sir W. Donovan that the names originally suggested should stand, and that the matter be referred to the Memorials Sub-committee for the necessary action.

(4) Correspondence relating to the selection of an artist to paint a special portrait of Lieut.-Gen. Sir A. Keogh was read and it was decided to request Mr. Arthur Hacker, R.A., to undertake the task at the cost agreed upon, viz., 400 guineas exclusive of the frame.

(5) Two cases of special distress were considered under Rule 5 and it was decided to continue the grant authorized by the Meeting held on July 17 to the widow of F. W. H. D. H. up to a total of £50. It was considered that the second case does not come within the scope of the Rule and the application was not approved.

(6) Five applications for assistance from the General Relief Branch were considered and the following grants were approved—

Mr. A. T. to receive the balance of the amount authorized by the meeting held on July 17, viz.	£3	0	0
Mr. W. F. C. and wife	6	0	0
Mr. J. R. S. and wife	2	0	0
Mr. T. P. (This case is referred to the Auxiliary R.A.M.C. Fund)	2	0	0
The widow of the late F. T. M.	6	0	0

ROYAL ARMY MEDICAL CORPS.

Band Fund.

Statement showing Receipts and Expenditure from April to September, 1918.

Income.	£	s.	d.	Expenditure.	£	s.	d.
Balance brought forward	181	11	11	Salaries of Bandmaster, Band Serjeant and Storeman..	79	13	0
Fees for Performances on Victoria and Central Piers ..	54	0	0	Bandmaster and Men, Pay for Peformances on Victoria and Central Piers	32	10	0
				Postage and Telegrams	0	7	2
				Insurance	2	17	9
				Bandmaster's Uniform	5	2	6
				Repairs to Instruments	2	1	9
				Music, Strings and Instruments	35	10	0
				Balance in hand	77	9	9
	£235	11	11		£235	11	11

Certified correct,

E. B. ALLNUTT, *Captain R.A.M.C.*,
President, R.A.M.C. Band.

Blackpoool,
October 21, 1918.

Certified that the accounts of the Depot, R.A.M.C., Band have this day been audited and found correct.

A. JACKSON, *Major R.A.M.C.*
A. HYNDMAN, *Lieutenant K.S.L.I.*

Blackpool,
October 10, 1918.

(7) The Secretary reported the present cash balances in both branches and it was decided to invest a further amount of £500 on account of the General Relief Branch in National War Bonds five per cent 1928 series.

(8) The Band President submitted the Band accounts for the past six months and a grant of £60 was authorized from the Officers Branch.

(9) The question of a grant to the Prisoners of War Fund from the General Relief Branch was considered and it was decided that it would be better to approach the Central Committee, 4, Thurloe Place, for assistance should it become necessary.

(10) An appeal was read from the Army and Navy Male Nurses' Co-operation and a grant of £20 authorized.

ROYAL ARMY MEDICAL CORPS PRISONERS OF WAR FUND.

OFFICIAL CARE COMMITTEE RECOGNIZED BY THE WAR OFFICE FOR THE ROYAL ARMY MEDICAL CORPS.

THE Honorary Treasurer has now the pleasure of submitting the fifth List of Contributions to the above Fund containing all subscriptions up to the middle of September, from Units at home and abroad. It will be noticed that many of these are renewed or additional donations, and several Units have generously promised grants to be repeated monthly, or as their general funds permit.

The Honorary Treasurer trusts that all Officers Commanding will impress upon the Committees of their Regimental Institutes where such exist, the necessity of supporting this Fund for the benefit of their comrades in captivity in order that the regular supply of parcels of food may be kept up. The large increase in the number of prisoners, now exceeding 1,100, and in the cost of provisions, entails a very large monthly expenditure, which has hitherto been met by the Corps itself and by numerous friends.

If subscriptions are not maintained an appeal for outside assistance will soon be unavoidable.

124, *Victoria Street, S.W.* E. M. WILSON, *Lieut.-Colonel,*
September 25, 1918. *Hon. Treasurer.*

FIFTH LIST.

LIST OF COMPANIES AND UNITS AT HOME AND ABROAD, CONTRIBUTIONS TO THE PRISONERS OF WAR FUND IN 1918.

	£	s.	d.
July 25—			
Cliff Military Hospital	£3	8	0
July 29—			
No. 12 Field Ambulance	5	0	0
R.A.M.C. Depot, Blackpool	500	0	0
July 30—			
2nd London General Hospital (Chelsea)	41	3	6
August—			
R.A.M.C. School of Instruction (Officers), Blackpool	63	9	6
2nd Wessex Field Ambulance (T.F.)	40	0	0
Military Hospital, Fovant	5	0	0
30th General Hospital	36	15	0
No. 19 Company, Chester (further contribution)	50	0	0
Serjeant's Mess, No. 3 General Hospital	2	0	0
Queen Mary's Military Hospital, Whalley (further contribution)	25	0	0
7th Training Battalion, R.A.M.C., Blackpool	17	19	2
19th Field Ambulance	18	8	4
Military Hospital, Newhaven	9	9	0
24th General Hospital	3	14	0
2nd Wessex Field Ambulance (2nd donation)	40	0	0
2/2nd North Midland Field Ambulance (monthly contribution)	7	6	0
R.A.M.C. Mess, Sheerness	6	6	0
46th Stationary Hospital	33	0	0
50th Field Ambulance	3	3	0
Military Hospital Mess, Catterick and Regimental Institutes	£10	2	0
Detachment 1st Birmingham War Hospital, Kidnal	1	16	0
Detachment R.A.M.C., Gosport (3rd donation)	0	14	3
Lieut.-Col. H. P. and Mrs. Corkery, Central Hospital, Winchester	319	3	6
Lieut.-Col. H. E. Winter and No. 6 Company	20	0	0
4th Training Battalion, Blackpool	7	0	0
2nd Wessex Field Ambulance (3rd donation)	40	0	0
4th Northern General Hospital, R.A.M.C. (T.)	25	0	0
St. George's Garrison Church, Woolwich	20	0	0
5th Training Battalion, Blackpool	16	0	0
1st Training Battalion, Blackpool	5	0	0
6th Training Battalion, Blackpool	10	0	0
28th Field Ambulance	5	0	0
Provisional Company (now Reserve Battalion) Depot, Blackpool "Cough Drops" Concert Party	200	0	0
133rd British General Hospital, Mesopotamia, Regimental Institute	7	10	0

O.C. 6th Company (additional), Portsmouth	£5	2	0
No. 1 Duchess of Westminster's Hospital Wt., N.C.O.s and Men	16	0	0
No. 1 Duchess of Westminster's Hospital Regimental Funds ..	12	0	0
Convalescent Hospital, Holywood, County Down	5	0	0
44th Casualty Clearing Station ..	7	7	2
29th Company, Jamaica (2nd donation)	1	0	0
4th Stationary Hospital ..	39	19	4
St. John Ambulance Brigade Hospital, France (630 fr.)	23	10	8
65th British General Hospital, Mesopotamia	5	0	0
53rd General Hospital, Serjeants' Mess	2	18	0
No. 6 Company (additional) ..	3	12	6
Serjeants' Mess, 3rd Native General Hospital, B.E.F., France	10	0	0
26th Company, Bermuda (further contribution)	1	5	0
Detachment, 8th Company, Middlesbrough, Yorkshire ..	2	0	0
3rd Training Battalion, Blackpool	5	0	0
No. 6 Company Detachment, Dorchester	1	5	6
No. 6 Company, Cosham (additional)	2	2	0
No. 6 Company Detachment, Alderney	0	10	0
No. 6 Company, Romsey ..	0	13	3
August 27—			
8th Training Battalion, Blackpool (monthly contribution) ..	5	0	0
2nd Training Battalion, Blackpool (annual in advance) ..	12	0	0
2/1st Wessex Field Ambulance ..	6	4	1
August 30—			
R.A.M.C. Detachment, Christchurch, 6th Company	0	11	0
Nos. 12 and 34 Companies, Royal Herbert Hospital, Woolwich ..	20	0	0
Nos. 12 and 34 Detachments, Warlingham	11	5	0
Nos. 12 and 34 Detachments, Dartford	10	0	0
76th Casualty Clearing Station (further donation)	0	12	0
6th Training Battalion, Blackpool	8	18	0
No. 20 Casualty Clearing Station	20	0	0
Officers No. 25 Casualty Clearing Station Wt., N.C.O.s and Men	25	0	0
Officers No. 25 Casualty Clearing Station, Salonika	£7	0	0
No. 35 Company, R.A.M.C. ..	20	0	0
2nd Wessex Field Ambulance (4th donation)	50	0	0
R.A.M.C. Detachment, Bermuda (further subscription)	1	0	0
No. 44 Casualty Clearing Station Officers, Sisters and other ranks	6	0	0
O.C. No. 6 Company, Cosham ..	43	4	9
O.C. No. 6 Company, Cosham ..	1	2	0
O.C. 1st Casualty Clearing Station	5	0	0
7th Training Battalion, R.A.M.C., Blackpool	20	3	2
No. 9 Company, Colchester (2nd subscription)	125	11	3
No. 12 Field Ambulance ..	5	0	0
42nd General Hospital, Salonika	30	10	0
55th Casualty Clearing Station	4	0	0
No. 6 Company, R.A.M.C. Detachment, Parkhurst, Isle of Wight	4	16	0
Cliff Military Hospital, Harwich (further donation)	2	2	3
8th Training Battalion, Blackpool	5	0	0
75th Field Ambulance (sports collection)	3	0	0
Croydon War Hospital	3	5	6
329th Field Ambulance	5	0	0
Detachment, R.A.M.C.. Fort George	0	14	6
70th Sanitary Section	2	1	0
2/2nd North Midland Field Ambulance (monthly subscription)	7	6	0
Detachment, R.A.M.C., Jersey	0	11	0
2/1st Highland Field Ambulance	16	0	0
Regimental Funds, 1st Training Battalion, Blackpool	5	0	0
Mr. A. L. Martin and Staff Clerks, R.A.M.C., Salisbury	0	10	0
Detachment, R.A.M.C., No. 6 Company, Parkhurst, Isle of Wight (further contribution) ..	0	10	6
3rd Training Battalion, Blackpool (monthly subscription) ..	5	0	0
49th General Hospital, Salonika	10	0	0
2nd Wessex Field Ambulance (additional)	30	0	0
R.A.M.C. Depot, Blackpool ..	400	0	0
Military Hospital, Woking ..	10	16	6
Kent County Comforts Fund, from Vice-Lieutenant ..	90	8	6
St. Thomas's Church, Shepherd's Bush	2	10	0

BIRTH.

LONG.—On September 16, at Sandhills, Reading Road, Fleet, Hants, the wife of Major H. W. Long, Royal Army Medical Corps, a daughter.

ROYAL ARMY MEDICAL COLLEGE.

LIST OF BOOKS ADDED TO THE LIBRARY DURING THE MONTHS OF JULY, AUGUST AND SEPTEMBER, 1918.

Title of Work and Author	Edition	Date	How obtained
The Diagnosis and Treatment of Venereal Diseases. By Lieut.-Col. L. W. Harrison, D.S.O., R.A.M.C.		1918	Library Grant.
Laboratory Manual for the Detection of Poisons and Powerful Drugs. By Dr. W. Autenrieth. Translated by W. H. Warren	4th	1915	,, ,,
Pathogenic Micro-organisms. By Park and Williams ..	6th	1917	,, ,,
Treatment of Joint and Muscle Injuries. By W. R. Bristow		1917	,, ,,
La Granulation Aurophile. Par le Dr. L. M. Bétanus ..		1918	Editor, Journal.
British Museum (Natural History). A Map showing the known Distribution in England and Wales of the Anopheline Mosquitoes. With Explanatory Notes and Text. By W. Dickson Lang, M.A.		1918	,, ,,
Notes on the Application of the Test of Organic Disease of the Spleen, as an easy and certain Method of detecting Malarial Localities in Hot Climates. By Surg. T. C. Dempster, 1848. Reprinted		1916	War Office, A.M.D.Q.
Spud Wilkins at Blackpool. By Sergt. H. V. Verriss ..		1918	Editor, *R.A.M.C. Magazine*.
R.A.M.C. Magazine, July 5 to September 27		1918	The Editor.
Journal of the Royal Naval Medical Service, July ..		1918	,, ,,
London County Council. Report of the County Medical Officer of Health and School Medical Officer for the year 1917		1918	London County Council.
Medical Research Committee. Reports of the Special Investigation Committee on Surgical Shock and Allied Conditions, No. 5		1918	Medical Research Committee.
Reports of the Committee on War Nephritis, No. 3 ..		1918	,, ,,
Reports of the Chemical Warfare Committee, No. 8 ..		1918	,, ,,
Statistical Reports, No. 1		1918	,, ,,
Medical Research Institute, Lagos, Nigeria. Report for the year 1916. By A. Connal, M.D.		1918	The Director.
National Health Insurance. Medical Research Committee, Special Report Series, No. 18. An Investigation into the Epidemiology of Phthisis in Great Britain and Ireland		1918	War Office, A.M.D.Q.
Special Report Series, No. 19. Reports of the Special Committee on the Standardization of Pathological Methods. The Laboratory Diagnosis of Gonococcal Infections. Methods for the Detection of Spirochætes		1918	,, ,,
The Montana State Board of Entomology :—			Presented by Surg.-Gen. Sir D. Bruce, K.C.B., F.R.S.
First Biennial Report, 1913-14		1914	
Second ditto, 1915-16		1916	
Archives of Neurology and Psychiatry. Vol. vii. Edited by F. W. Mott, M.D., LL.D., F.R.S.		1918	Presented by the Editor.
Two Addresses on War Psycho-Neurosis—(1) Neurasthenia. The Disorders and Disabilities of Fear. (2) The Psychology of Soldiers' Dreams. By F. W. Mott, M.D., LL.D., F.R.S.		1918	Presented by the Author.
Commonwealth of Australia. Department of Trades and Customs. Final Report on the Cause of Death and Invalidity in the Commonwealth		1918	Chairman of the Committee.

EXCHANGES, &c.

A free issue of twenty-five reprints will be made to contributors of Original Communications, and of twenty-five excerpts of Lectures, Travels and Proceedings of the United Services Medical Society.

Any demand for reprints, additional to the above, or for excerpts, must be forwarded at the time of submission of the article for publication, and will be charged for at the following rates, and additional copies at proportionate rates:—

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	8	0 5 0	0 2 3				
	16	0 8 3	0 3 11				
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	8	0 6 0	0 2 9				
	16	0 10 6	0 5 0				
50	4	0 4 6	0 1 10	6 0	2 1	4 10	1 2
	8	0 7 6	0 3 6				
	16	0 13 3	0 5 10				
100	4	0 6 0	0 3 1	7 10	3 11	6 7	2 5
	8	0 10 0	0 4 10				
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200	4	0 9 6	0 4 5	10 10	7 6	9 0	4 10
	8	0 15 0	0 6 7				
	16	1 6 0	0 9 8				

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The above figures are subject to 25 per cent increase.

All Applications for Advertisements to be made to—

G. STREET & CO., Ltd., 8, Serle Street, London, W.C.

The back outside cover is not available for advertisements.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are

inserted free of charge to subscribers and members of the Corps. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS," 324, Adastral House, Victoria Embankment, E.C. 4.

Communications have been received from Major C. A. S. Ridout; Lieutenant G. T. P. Tatham.

The following publications have been received:—

British: The Journal of State Medicine, Tropical Diseases Bulletin, The Indian Medical Gazette, Journal of the United Service Institution of India, The Medical Press, The Medical Review, The Journal of Tropical Medicine and Hygiene, The Army Service Corps Journal. Bulletin of the Canadian Army Medical Corps, The Medical Journal of Australia, The Royal Engineers Journal, Journal of the Royal Naval Medical Service, Guy's Hospital Gazette, The Hospital, The Practitioner, Seale Hayne Neurological Studies, Report of Port of Sydney, Proceedings of the Royal Society of Medicine.

Foreign: United States Public Health Service, War Medicine, Tidskrift I Militär Hälsovard, Bulletin de l'Institut Pasteur, Giornale di Medicina Militare, Archives Médicales Belges, Archives de Médicine et Pharmacie Navales, The Journal of Infectious Diseases, Journal of Agricultural Research, Arquivos do Institute Bacteriologico, Camara Pestana, United States Department of Agriculture, Office International d'Hygiene Publique, Norsk Tidskrift for Militaermedicin, Bulletin of the Johns Hopkins Hospital, Archives de Medicine et de Pharmacie Militaires, Surgery, Gynæcology and Obstetrics.

MANAGER'S NOTICES.

The JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is published monthly, six months constituting one volume, a volume commencing on 1st July and 1st January of each year.

The Annual Subscription is £1 (which includes postage), and should commence either on 1st July or 1st January; but if a subscriber wishes to commence at any other month he may do so by paying for the odd months between 1st July and 1st January at the rate of 1s. 8d. (one shilling and eightpence) per copy. (All subscriptions are payable in advance.)

Single copies can be obtained at the rate of 2s. per copy.

The Corps News is also issued separately from the Journal, and can be subscribed for at the rate of 2s. (two shillings) per annum, including postage. Subscriptions should commence from 1st July each year; but if intending subscribers wish to commence from any other month, they may do so by paying for the odd months at the rate of 2d. per copy. (All subscriptions are payable in advance.)

Officers of the Royal Army Medical Corps possessing Diplomas in Public Health, etc., are kindly requested to register their special qualifications at the War Office. Letters of complaint are frequently received from officers stating that their special qualifications have not been shown in the Distribution List which is published as a supplement to the Journal in April and October of each year. As. however, the particulars of this list are supplied from official sources, officers are reminded that unless the possession of Diplomas, etc., has been registered at the War Office, no entry of such qualifications can be recorded in the Distribution List.

Letters notifying change of address should be sent to the Hon. Manager, "Journal of the Royal Army Medical Corps." 25, Adastral House, Victoria Embankment, E.C. 4, and must reach there not later than the 20th of each month for the alteration to be made for the following month's issue.

It is requested that all Cheques or Postal Orders for Subscriptions to the Journal, Corps News, Reprints, etc., be crossed "Holt & Co.," and made payable to the "Hon. Manager, Journal R.A.M.C.," and not to any individual personally.

All communications for the Hon. Manager regarding subscriptions, etc., should be addressed to

THE HON. MANAGER,
"JOURNAL OF THE ROYAL ARMY MEDICAL CORPS,"
25, ADASTRAL HOUSE, VICTORIA EMBANKMENT, E.C.4.

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

November, 1918.

EXTRACTS FROM THE "LONDON GAZETTE."

War Office,
October 15, 1918.

His Majesty The King has been graciously pleased to approve of the following awards to the undermentioned Officers and Warrant Officers in recognition of their gallantry and devotion to duty in the Field :—

Awarded the Distinguished Service Order.

Temp. Capt. William Grahame Cobb, M.B., Royal Army Medical Corps, attached K.A.R.

For conspicuous gallantry and devotion to duty in action. For six hours, in the middle of a desperate fight at close quarters, he maintained his dressing station and attended the many wounded. Enemy's fire was coming from three directions, and the only cover was two ant-heaps. He frequently went forward to the firing line and brought in wounded at great personal risk. He undoubedly saved many lives by his perseverance and determination, all the wounded being safely evacuated under the greatest difficulties.

Temp. Capt. (Acting Major) John Greene, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during an enemy attack. Although his advanced dressing station was heavily shelled and gassed he continued at duty, encouraging all by his courage and resourcefulness. He worked continuously for thirty hours, visiting his bearers' posts under heavy shell fire, and only rested when all wounded had been evacuated. His magnificent devotion to duty saved many lives.

Awarded a Second Bar to the Military Cross.

Temp. Capt. (Acting Major) Daniel McKelvey, M.C., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty as liaison medical officer. He constantly kept touch with brigade and battalion headquarters, moving over roads and ground exposed to heavy shelling. His tireless energy, organizing ability, and disregard of danger were largely instrumental in the successful clearing of casualties from the line. (M.C. gazetted July 18, 1917.)

Awarded a Bar to the Military Cross.

Temp. Capt. John Charles Boileau Grant, M.C., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He attended to wounded men lying in the open under heavy fire, and subsequently for three days and nights, with little rest, he was constantly out with stretcher bearers searching for and removing the wounded. He was undoubtedly the means of saving many lives, and his fine example was of the greatest value at a very trying time. (M.C. gazetted September 26, 1917.)

Temp. Capt. John Nelson Humphrey, M.C., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during an enemy attack. As bearer officer he repeatedly led his men up to the front line under very heavy fire. When the normal line of evacuation was broken he carried out a reconnaissance in full view of the enemy, and established a new means of communication, himself assisting to remove a tree across a road which was heavily shelled. By his courage and resource he contributed largely to the rapid evacuation of the wounded, and saved many lives. (M.C. gazetted January 1, 1918.)

Temp. Capt. Charles Clouston Irvine, M.C., R.A.M.C.

For conspicuous gallantry and devotion to duty. When the shelter in which he was working received a direct hit from a shell, the explosion of which killed his serjeant and an

orderly who were helping him, he was severely shaken, but rallied himself, and continued to attend to the wounded. A panic which might have ensued among the wounded and shell-shocked soldiers was averted by his courage and determination. (M.C. gazetted July 18, 1917.)

Temp. Capt. William Graeme Denroche McCall, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. When the enemy put down a heavy barrage, causing many casualties in his own and other units, he arranged for the collection of wounded, and attended them with the greatest coolness in the open, which necessitated his remaining in the barrage. Throughout the operations his energy and devotion to duty were admirable. (M.C. gazetted July 26, 1918.)

Capt. (Acting Major) Campbell McNeil McCormack, M.C., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. During an important engagement he organized the evacuation of the wounded with great skill and devotion to duty, proceeding frequently himself in charge of bearers, through heavy shelling, to the rear aid posts. It was largely due to his able organization and fine example of self-sacrificing gallantry that the numerous casualties were evacuated so expeditiously. (M.C. gazetted September 22, 1916.)

Australian Imperial Force.

Capt. Vernon Carlisle Brown, M.C., Army Medical Corps.

For great courage and resource in evacuating wounded from a forward area. The routes were being heavily shelled, and he established bearer relay posts in suitable positions after a full reconnaissance of the ground. During the whole operation his perseverance and initiative contributed largely to a quick evacuation of the wounded, while his energy and example stimulated the men. (M.C. gazetted November 19, 1917).

AWARDED THE MILITARY CROSS.

Capt. (Acting Major) Galvin Alexander Elmslie Argo, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. While in charge of a light section of a cavalry field ambulance during an attack he performed most useful work. His brigade sustained considerable casualties, and he organized a stretcher party and rescued several wounded, though the ground was being shelled at the time. He showed great coolness and devotion to duty.

Temp. Capt. Stanley Arthur Bull, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty in helping under continuous shell fire to dig out several men who had been wounded and buried. He attended men under conditions which demanded considerable nerve and determination.

Capt. John Victor Livingstone Grant, M.B., Royal Army Medical Corps, Special Reserve.

For conspicuous gallantry and devotion to duty when his ambulance was attacked on the march by enemy aeroplanes. A large ammunition dump at the side of the road was exploded, igniting a lorry loaded with petrol, and the fire spread to the ambulance wagons. He immediately collected men and for two hours worked coolly and fearlessly near the exploding dump, under repeated bombing attacks from aircraft, tending and removing the wounded.

Capt. Robert Lawson, M.B., Royal Army Medical Corps.

During several days' operations he worked continuously at high pressure under heavy shell fire. His energy and care for the wounded under the most difficult circumstances were beyond all praise, and he showed great gallantry and devotion to duty in organizing his bearers and collecting wounded from a heavily shelled area, thereby saving many lives.

Temp. Capt. Henry Leslie Messenger, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty while an exceptionally heavy shoot was being carried out on a battery. He crossed 400 yards in the open under heavy barrage to attend to a wounded man. On his way he was knocked down by an exploding shell, but in spite of this he proceeded with his duties. He showed great grit and determination.

Temp. Capt. Stanley Andrew Woollaston Munro, M.B., Royal Army Medical Corps.

He organized his advanced dressing station and stretcher-bearing parties under very difficult circumstances, and when it was found necessary to withdraw the battalion to the original position, he reorganized the stretcher-bearers and himself took up a post in the front line where he could better render assistance to the wounded. He also went and bandaged a wounded man who was lying in a position that was being shelled, and had him conveyed to safety. Throughout his cheerfulness, energy and disregard for his own personal safety, had a most inspiring effect on all.

Temp. Capt. Andrew Neilson, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty when a number of wounded were left after a cavalry charge. He took two light ambulances and a bearer party right up to the front line and cleared five wounded lying out in front. This was done under continuous machine-gun fire directed on the road in the dark. He showed great courage and initiative.

Temp. Lieut. Wilfred Paton Philip, M.B., Royal Army Medical Corps.

During an attack he showed great gallantry in attending to a large number of wounded. He three times had to move his dressing station on account of shell fire, but stuck to his duties with great determination and saved many lives.

Temp. Capt. (Acting Major) Clive Justin Hicks Sharp, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He most ably supervised the evacuation of wounded during a rapid advance. Moreover, on hearing that one of the advanced dressing stations had been hit by a bomb, he at once went to the spot and helped with the wounded, and his coolness and energy were of the greatest assistance in reorganizing the dressing station under shell fire, so that the evacuation of the wounded proceeded uninterruptedly.

Temp. Capt. John Patrick Shaw, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. Under severe enemy shelling he carried on his work in the open, his aid post affording neither space nor protection. He did invaluable service under most trying circumstances, as his was the collecting station both for his own battalion and for the brigade front. He showed magnificent energy and devotion to duty.

Capt. (Acting Major) James Martin Smith, M.B., Royal Army Medical Corps.

For conspicuous devotion to duty when an enemy shell exploded an ammunition dump near his dressing station. He rushed to the spot, organized a rescue party regardless of exploding shells, and continued to attend to the wounded until all were removed to safety. He saved many lives by his gallant conduct.

Temp. Capt. Andrew William Palethorpe Todd, M.B., Royal Army Medical Corps.

During an attack this officer, who was stationed at the advanced collecting post, behaved with great gallantry under the heavy artillery fire to which his post was subjected at frequent intervals during the day. He dressed and attended to large numbers of wounded men with unremitting devotion to duty, and also went forward under heavy fire with stretcher-bearers to the aid posts, and by his able leadership rendered valuable service in evacuating the wounded.

Canadian Force.

Capt. Benjamin Lyon, Army Medical Corps.

For conspicuous gallantry and devotion to duty in action. After a charge by two squadrons up a road this officer followed on foot, and attended and evacuated the wounded under heavy artillery and machine-gun fire, remaining there until all the wounded were brought in.

Capt. Walter James Ellis Mingie, Army Medical Corps.

For conspicuons gallantry and devotion to duty during an attack. He maintained close touch with all the regiments, and under heavy shell and machine-gun fire he evacuated all casualties with wonderful rapidity. Hearing that an officer was seriously wounded in the front line trench, he immediately went forward and succeeded in dressing and removing him. He showed the greatest coolness and resource throughout.

Australian Imperial Force.

Capt. Isaac Manly Barrow, Australian Army Medical Corps.

Under heavy fire he dressed wounded in an open trench, and when the battalion attacked he advanced with them and established his dressing station behind the front line. When two of his bearers were wounded carrying a casualty he dashed forward under direct machine-gun fire to their assistance. Later, he was severely wounded. Throughout the operations he showed conspicuous gallantry and devotion to duty.

Capt. George Albert Blumer, Australian Army Medical Corps.

For conspicuous gallantry and devotion to duty. When the R. A. P. was heavily shelled, a direct hit causing casualties amongst the staff, he succeeded, single-handed, in getting the wounded away, and attended to many cases in the area of the bombardment. Throughout the period his courage and determination saved many lives.

AMENDMENTS.

The following are the correct descriptions of Officers upon whom Rewards have recently been conferred :—

Capt. George Baird Moffatt, D.S.O., South African Medical Corps. (D.S.O. gazetted August 22, 1918).

Capt. Charles Newton-Davis, M.C., M.B., I.M.S. (M.C. gazetted March 26, 1918).

War Office,
October 15, 1918.

His Majesty the King has been graciously pleased to approve of the award of the Meritorious Service Medal to the undermentioned Warrant Officers, Non-commissioned Officers and Men in recognition of valuable services rendered with the Forces in Mesopotamia during the present war :—

ROYAL ARMY MEDICAL CORPS.

75963 Pte. G. Ambler (Kentish Town).
16317 Pte. S. Davenport (Coventry).
97906 Pte. (Acting Lance-Cpl.) W. Drummond (Camden Town).
328019 Pte. C. Fischbacher (Cambuslang).
27348 Serjt. W. Greenwood (Carholme).
23542 Serjt. (Acting Staff-Serjt.) A. E. Hughes (Portmadoc).
14926 Serjt.-Major W. H. G. Hunt (Southwark).
4435 Pte. (Acting Cpl.) J. G. Hunter (Middlesbrough).
32621 Pte. (Acting Serjt.) A. Johnson (Black Notley).

25648 Serjt. (Acting Staff-Serjt.) J. H. Jones (Crewe).
69958 Staff-Serjt. H. Latter (Staines).
545356 T. H. Legge (Highgate).
35550 Serjt. (Acting Staff-Serjt.) H. G. Price (Smethwick).
97911 Pte. J. Rudd (Kingsbridge).
24681 Staff-Serjt. W. Smith (Scarborough).
70345 Pte. W. H. Wheele (Chepstow).

War Office,
October 21, 1918.

With reference to the announcement of the award of a Bar to the Distinguished Conduct Medal which appeared in the *Lonaon Gazette* dated June 3, 1918, the following are the acts of gallantry for which the decoration has been awarded :—

536001 Qmr.-Serjt. (Temp. Serjt.-Major) H. E. Bevans, Royal Army Medical Corps (St. John's, S.E).

For conspicuous gallantry and devotion to duty as R.M.S. for a period of six months. He showed great initiative and resource in organizing a regular supply of medical stores for the forward area and in controlling the transport for the evacuation of the wounded. On more than one occasion he organized stragglers under heavy shell fire for the purpose of clearing the wounded.

354259 Pte. E. C. Bowkett, Royal Army Medical Corps (Manchester).

For conspicuous gallantry and devotion to duty. During the period of an attack he displayed fine courage and resource with his stretcher squad in evacuating the wounded under difficult conditions and constant shell fire and in directing other squads through the mud.

303003 Staff-Serjt. (Acting Qmr.-Serjt.) J. Brown, Royal Army Medical Corps (Aberdeen).

For conspicuous gallantry and devotion to duty. For three years he has devoted himself assiduously to his work. Capable and reliable, by his splendid example and good discipline he has encouraged the best work from those under him. At advanced posts during active operations he has done his utmost for the wounded, with a complete disregard for his own safety.

55195 Serjt. D. Charleson, Royal Army Medical Corps (Leith).

For conspicuous gallantry and devotion to duty. He performed consistently good work, especially at advanced dressing-stations and when in charge of bearers. He has frequently shown coolness and devotion to duty under heavy fire.

18627 Staff-Serjt. B. Cockburn, Royal Army Medical Corps (Southampton).

For conspicuous gallantry and devotion to duty. He has invariably displayed conspicuous coolness and energy in collecting and dressing wounded under heavy fire, and has throughout rendered most excellent service by his unselfish zeal and unfailing devotion to duty.

354100 Serjt. H. E. Dowling, Royal Army Medical Corps (Manchester).

For conspicuous gallantry and devotion to duty. He showed unremitting zeal and courage under heavy fire, and always set a fine example to the bearers under his charge.

390188 Serjt. A. Green, Royal Army Medical Corps (Hull).

For conspicuous gallantry and devotion to duty with the bearer division, when he showed great energy and courage under heavy fire. Also as non-commissioned officer at the advanced dressing station, he reorganized the sanitation of the post with much ability, and remained there at his own request for three weeks, though it was heavily shelled on several occasions.

546124 Cpl. (Acting Co. Serjt.-Major) L. T. Leybourne, Royal Army Medical Corps (Cambridge).

For conspicuous gallantry and devotion to duty during operations whilst in charge of company detachments with divisional troop units. It was entirely owing to his untiring efforts, tact and loyalty that the native drivers kept a high standard of moral, which enabled him to successfully carry out his duties.

352080 Serjt. R. Lomax, Royal Army Medical Corps (Nelson).

For conspicuous gallantry and devotion to duty. He proved himself to be full of resource and nitiative in the forward area when the shelling was very intense. A very gallant man, he always set a fine example to the stretcher-bearers under him.

32251 Serjt.-Major G. F. Lyon, Royal Army Medical Corps (Norwich).

For conspicuous gallantry and devotion to duty. Ever since mobilization he has shown conspicuous devotion to duty and continuous good work, both in and out of action, and by his courage, coolness and unfailing energy at all times he has set a splendid example to all ranks.

12496 Staff-Serjt. (Acting Serjt.-Major) J. McKay, Royal Army Medical Corps (Aberdeen).

For conspicuous gallantry and devotion to duty. When in charge of bearer sub-division, his officer having been temporarily withdrawn, he worked unceasingly day and night getting wounded away over difficult ground and constantly exposed to heavy fire. He has consistently displayed great bravery and disregard of personal danger and has set a magnificent example of devotion to duty.

17091 Qmr.-Serjt. (Acting Serjt.-Major), J. Moore, Royal Army Medical Corps (Edinburgh).

For conspicuous gallantry and devotion to duty during active operations. He was often on continuous duty for seventy-two hours. By the splendid example he has shown he was able to

get the maximum amount of energy and efficiency from all other ranks, which was essential for the successful handling of large numbers of wounded.

1417 Pte. (Acting Lance-Cpl.) C. Smith, Royal Army Medical Corps (Winchester).

For conspicuous gallantry and devotion to duty. When a shelter containing wounded was being shelled he displayed great courage. He was largely instrumental in having the wounded removed to safety, but was himself buried and wounded when the shelter was blown in. He also rendered invaluable service as a dresser with the ambulance.

October 21, 1918.

His Majesty the King has been graciously pleased to approve the award of a Bar to the Military Medal to the undermentioned Non-commissioned Officers and Men :—

386299 Pte. J. Clough, M.M., Royal Army Medical Corps (Portobello). (M.M. gazetted December 9, 1916.)

388063 Serjt. T. Robins, M.M., Royal Army Medical Corps (Darlington). (M.M. gazetted December 9, 1916.)

388452 Cpl. H. Pallister, M.M., Royal Army Medical Corps (North Shields).

48721 Pte. R. S. Cunningham, M.M., Royal Army Medical Corps (Illinois, U.S.A.).

488 Pte. A. Haddow, M.M., Royal Army Medical Corps (Glasgow).

His Majesty the King has been graciously pleased to approve of the award of the Military Medal for bravery in the field to the undermentioned Warrant Officers, Non-commissioned Officers and Men :—

ROYAL ARMY MEDICAL CORPS.

386480 Pte. E. Adams (Newcastle-on-Tyne).
92964 Pte. D. C. Adamson (Aberdeen).
386283 Pte. W. Anderson (Gateshead-on-Tyne).
390218 Lance-Cpl. R. Atkinson (Hull).
66640 Pte. W. Bailey (Bideford).
50299 Lance-Cpl. W. Boyden (Cannock).
341525 Serjt. W. Bretherton (Chorley, Lancs).
341484 Pte. (Acting Cpl.) A. Brooks (St. Helens).
76061 Pte. E. W. Brown (Brewood).
437157 Pte. T. Butler (Birmingham).
42416 Pte. (Acting Cpl.) M. Chatterton (Birmingham).
6233 Pte. (Acting Serjt.) T. Cox (Dundee).
64888 Pte. P. Doyle (South Queensferry).
386538 Pte. J. Forbes (Newcastle-on-Tyne).
62116 Pte. F. J. Gibbons (London, W.).
1781 Pte. A. H. Goddard (Greenwich).
390051 Pte. J. Gorman (Hull).
388209 Pte. H. Grainger (Shildon).
1518 Pte. J. M. Grant (Edinburgh).
390188 Serjt. A. Green (Hull).
43398 Lance-Cpl. D. T. Griffiths (Ferndale, Glam.).
24664 Cpl. A. V. Henderson (South Shields).
62344 Pte. (Acting Serjt.) J. H. Higham (Sheffield).
442143 Lance-Cpl. C. Hill (Birmingham).
23968 Pte. J. G. Hodgson (Sherburn Colliery).
36152 Cpl. (Acting Serjt.) J.T. Holmes (Leyton).
69063 Pte. (Acting Serjt.) J. H. Jones (Southley Mill, near Wrexham).
42462 Pte. H. Kay (Bolton).
32343 Pte. (now Cpl.) S. Kay (Wigan).
390086 Lance-Cpl. A. V. Love (Hull).
403468 Pte. A. Marshall (Leeds).
323007 Serjt. W. McKim (Helensburgh).
388304 Pte. W. Montgomery (Gateshead-on-Tyne).
386211 Pte. J. Moore (Newcastle-on-Tyne).
60433 Pte. S. C. Moreton (Bedford).
25177 Pte. E. Morville (Padiham).
390525 Pte. (Acting Lance-Cpl.) T. Murphy (Hull).
390150 Pte. C. B. Parkin (Hull).
386540 Pte. J. H. Parkin (Gateshead-on-Tyne).
27503 Pte. G. W. Pemberton (Todmorden).
388552 Pte. J. F. Perrott (Darlington).
386014 Qmr.-Serjt. (Temp. Serjt.-Major) P. T. Pickard (Liverpool).
42499 Pte. (Acting Cpl.) J. R. Pickering (Liverpool).
61213 Serjt. J. H. Pigg (Newcastle-on-Tyne).
64474 Pte. H. Robinson (Thringstone).
35281 Pte. J. J. Ryan (Arthur's Town, Co. Wexford).
390224 Serjt. C. Sanderson (Hull).
7954 Pte. A. Simpson (Leith).
341566 Pte. L. H. Smith (St. Helens).
60666 Pte. T. N. Spencer (Barnsley).
386164 Pte. E. Stephenson (Newcastle-on-Tyne).
437135 Cpl. (Lance-Serjt.) G. R. Stevenson (Broadheath).
61223 Serjt. A. W. Taylor (Reading).
386288 Pte. J. Thompson (Newcastle-on-Tyne).
58953 Pte. T. Walker (Elsecar).
421083 Pte. F. Ward (Willenhall).
386401 Pte. J. Wardell (Newcastle-on-Tyne).
419420 Pte. J. G. Webb (Moira Coalville).
48675 Pte. J. Wilcock (Peny-y-Myrydd).
30365 Pte. G. T. Williams (Liversedge).
527708 Serjt. (Acting Serjt.-Major) E. E. Willis (Southall).
73300 Pte. T. H. Wilson (Nottingham).
76650 Pte. H. Worship (Huddersfield).

War Office,
November 6, 1918.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for Distinguished Services rendered during the course of the campaign .—

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

DECORATIONS AND MEDALS CONFERRED BY THE PRESIDENT OF THE FRENCH REPUBLIC.

LEGION D'HONNEUR.

Croix de Chevalier.

Lieut.-Col. James Henry Hugo, D.S.O., M.B., Indian Medical Service.
Major Charles Ernest White Spinner Fawcett, M.B., Royal Army Medical Corps.

Croix de Guerre.

Lieut.-Col. Percy Gordon Brown, Canadian Army Medical Corps.
Lieut.-Col. Ranald Douglas Campbell, D.S.O., Australian Army Medical Corps.
Major (Temp. Lieut.-Col.) Reginald Thomas Collins, D.S.O., Royal Army Medical Corps.
Capt. William Pennefather Croker, M.B., Royal Army Medical Corps.
Capt. (Acting Major) John Dale, M.B., Royal Army Medical Corps.
Temp. Capt. John Luke Jackson, M.B., Royal Army Medical Corps.
Lieut.-Col. Alexander Barclay Lyon, M.D., Royal Army Medical Corps.
Lieut.-Col. Alexander Hammett Marks, D.S.O., Australian Army Medical Corps.
Capt. (Acting Major) George Singleton Parkinson, D.S.O., Royal Army Medical Corps.
Capt. (Temp. Col.) Sidney Maynard Smith, C.B., M.B., F.R.C.S., Royal Army Medical Corps and Army Medical Service.
Major (Temp. Lieut.-Col.) Valentine Osborne Stacy, Australian Army Medical Corps.
Major (Acting Lieut.-Col.) Charles Glendenning Thomson, D.S.O., Royal Army Medical Corps.
Lieut.-Col. John Tobin, Royal Army Medical Corps.
Capt. (Acting Lieut.-Col.) Thomas Blakeway Wolstenholme, M.B., Royal Army Medical Corps.
Capt. William Louis Rene Wood, M.C., Royal Army Medical Corps.
17277 Cpl. (Acting Serjt.) Robert Norman Knowles, Royal Army Medical Corps (St. Helens, Lancs.).
26100 Pte. Leopold Frederick Smith, Royal Army Medical Corps (Highbury, N.).
20708 Serjt. William Smith, Royal Army Medical Corps (Salford).
Col. Robert James Blackham, C.M.G., C.I.E., D.S.O., M.D., R.F.P.S., Army Medical Service.
Temp. Lieut. (Acting Major) Harold Goodman, M.B., Royal Army Medical Corps.
Temp. Capt. (Acting Major) Harold Bedford George Russell, Royal Army Medical Corps.
Major-Gen. James Barnett Wilson, C.B., C.M.G., M.D.
19604 Serjt. (Acting Serjt.-Major) Robert Pollock, Royal Army Medical Corps (Cork).
Lieut.-Col. (Temp. Col.) Alfred Bertram Soltau, C.M.G., M.D., F.R.C.S., Royal Army Medical Corps and Army Medical Service.

ARMY MEDICAL SERVICE.

The undermentioned are placed on retired pay :—
Dated October 22, 1918.—Col. James Meek, C.B., M.D.
Dated October 23, 1918.—Col. Benjamin James Inniss.
Dated October 24, 1918.—Major-Gen. Walter George Augustus Bedford C.B., C.M.G, M.B.
The undermentioned Lieutenants (Temp. Captains) to be Captains :—
Dated September 22, 1918.—Richard D. Davey, M.C., M.B.
Dated October 1, 1918.—Robert L. Ritchie, M.B.
Dated October 10, 1918.—Robert B. Myles, M.B.
Dated October 23, 1918.—Edmund S. Cuthbert.

Lieut.-Col. (Temp. Col.) Gerard W. Tate, D.S.O., M.B., from Royal Army Medical Corps, to be Colonel, dated December 26, 1917. (Substituted for the notification in the *Gazette* of June 12, 1918.)

Major Henry F. Shea, D.S.O., M.B., to be Acting Lieutenant-Colonel whilst specially employed, dated October 7, 1918.

Col. Sir William B. Leishman, Knt., K.C.M.G., C.B., F.R.S., M.B., F.R.C.P., K.H.P., to be Major-General, vice Major-Gen. Sir W. G. A. Bedford, retired, dated October 24, 1918.

The notification in the *Gazette* of October 21, 1918, regarding the retirement of Col. James Meek, C.B., M.D., is cancelled.

ROYAL ARMY MEDICAL CORPS.

Lieut.-Col. Farquhar McLennan, M.B., to be Acting Colonel whilst employed as Assistant Director of Medical Services of a Division, dated August 24, 1918.

Lieut.-Col. George M. Goldsmith, M.B., to be Acting Colonel whilst employed as Assistant Director of Medical Services of a Division, dated September 18, 1918.

Capt. David Pottinger, M.C., M.B., relinquishes the acting rank of Major on re-posting, dated July 4, 1918.

Capt. Edward G. H. Cowen, M.B., to be Acting Major whilst specially employed, dated September 25, 1918.

The undermentioned Majors to be Acting Lieutenant-Colonels:—

Dated September 14, 1918.—Robert W. D. Leslie, whilst employed as Assistant Director of Medical Services.

Dated September 16, 1918.—Arthur H. McN. Mitchell, whilst in command of a Medical Unit.

The undermentioned Majors relinquish the acting rank of Lieutenant-Colonel on re-posting:—

Dated September 17, 1918.—Thomas B. Moriarty, D.S.O.

Dated September 29, 1918.—Cuthbert G. Browne, D.S.O.

The undermentioned to be Acting Lieutenant-Colonel whilst employed as Assistant Director of Medical Services:—

Dated May 29, 1918.—Major (Brevet-Lieut.-Col.) Herbert V. Bagshawe, D.S.O.

The undermentioned to be Acting Lieutenant-Colonels whilst in command of Medical Units:—

Dated from May 2 to 26, 1918.—Capt. Edward A. Strachan, M.B.

Dated July 26, 1918.—Capt. James F. Grant, M.B.

Dated August 2, 1918.—Capt. Sydney J. Higgins.

Dated September 19, 1918.—Major Arthur W. Gater.

Dated September 24, 1918.—Major Frederick A. Stephens, D.S.O.

Dated September 28, 1918.—Capt. Alfred C. Elliott, M.B.; Major George De la Cour, M.B.

Dated October 1, 1918.—Major John J. O'Keeffe, M.C., M.B.

Dated October 3, 1918.—Lieut. (Temp. Capt.) Augustus J. Hickey, M.C.

The undermentioned relinquish the acting rank of Major on re-posting:—

Dated May 1, 1918.—Capt. Eric Catford.

Dated September 11, 1918.—Capt. Guy O. Chambers.

Dated September 16, 1918.—Capt. James Y. Moore.

The undermentioned to be Acting Majors:—

Dated January 15, 1918.—Capt. Henry Bedingfield, D.S.O., M.B.

Dated May 17, 1918.—Capt. Harry P. Rudolf, M.B.

Dated May 29, 1918.—Capt. Hector L. Howell, M.C.; Capt. Harry C. Todd, M.B.; Capt. Frank C. Cowtan; Capt. Thomas J. Haltinan, M.B.; Capt. Philip A. Opie, M.B.; Capt. Frederick P. Rankin; Capt. Herbert W. Carson, D.S.O., M.B.; Capt. Thomas F. Kennedy, M.B.

Dated September 3, 1918.—Lieut. (Temp. Capt.) Robert. L. Ritchie, M.B.

Dated September 5, 1918.—Capt. Thomas F. P. Breen, M.B.

Dated September 10, 1918.—Capt. David C. G. Ballingall, M.C., M.B.

Dated September 11, 1918.—Capt. Hugh G. Trayer, M.B.; Capt. Richard E. Gibson, O.B.E., M.B.

Dated September 13, 1918.—Capt. Christopher R. Dudgeon, M.C.

Dated September 14, 1918.—Capt. John R. Lloyd.

Dated September 16, 1918.—Capt. Carl K. G. Dick, M.C.

Dated September 17, 1918.—Capt. John P. Litt, M.D.

Dated October 7, 1918.—Capt. Duncan W. Pailthorpe, M.C.

The undermentioned Captains relinquish the acting rank of Major on re-posting:—

Dated September 23, 1918.—William F. Christie, M.B.

Dated October 1, 1918.—Thomas J. Kelly, M.C., M.B.

The undermentioned Lieutenants (Temp. Captains) to be Captains:—

Dated October 23, 1918.—John M. McKenzie, M.C., M.B.

Dated November 1, 1918.—Ralph R. Thompson, M.C.; (Acting Major) Arthur E. Richmond.

Dated November 7, 1918.—(Acting Lieut.-Col.) Augustus J. Hickey, M.C.

AUXILIARY ROYAL ARMY MEDICAL CORPS FUNDS.

The Annual General Meeting was held at 11, Chandos Street, on October 25, at 4 p.m.

Sir Alfred H. Keogh, G.C.B., G.C.V.O., was re-elected President; Lieut.-Gen. T. H. J. C. Goodwin, C.B., D.G.A.M.S., was elected as the new Vice-President; and Major W. F. Brook, Col. Sir Thomas Crisp English, A.M.S., Col. J. E. Gemmell, and Lieut.-Col. S. F. Irvine, were elected to the vacancies on the Committee.

The report of the recommendation of the Committee for grants up to September 30, 1918, was adopted.

The list of grants is as follows:—

Benevolent Branch.

Orphans of Capt. H. F. G. N.	.. £30	0	0	Orphans of Capt. A. Z. P. ..	.. £10	0	0
,, Major E. B. ..	.. 30	0	0	,, Capt. A. R. S. ..	.. 68	0	0
,, Lieut. J. N. ..	.. 20	0	0	,, Capt. F. H. ..	.. 10	0	0
,, Lieut. H. G. M.	.. 40	0	0	,, Capt. R. F. R. ..	.. 80	0	0
,, Capt. A. C. ..	.. 25	0	0	,, Capt. I. M. B. ..	.. 68	0	0
Lieut. A. K. A.	.. 15	0	0				

Relief Branch.

Widow and orphans of Pte. W. A. P.	£6	0	0	Widow and orphans of Cpl. C. J. B.	£8	15	0
,, ,, Pte. A. S.	8	0	0	,, ,, Pte. W. H.	6	0	0
,, ,, Pte. F. B.	5	0	0	,, ,, Pte. A. M. M.	5	0	0

At a Committee Meeting held previously, grants were made to orphans of seven officers amounting to £240, and to the widows and orphans of six members of the rank and file amounting to £234. These funds are for the education of the children of officers of the Auxiliary Royal Army Medical Corps who have lost their lives during the present war, or have been severely disabled by it. Also for the widows and children of similar members of the rank and file.

Requests for help as well as subscriptions should be addressed to the Hon. Secretary, 11, Chandos Street, Cavendish Square, London, W. 1.

ROYAL ARMY MEDICAL CORPS PRISONERS OF WAR FUND.

SIXTH LIST OF CONTRIBUTIONS

From Companies and Units at Home and Abroad to Prisoners of War Fund 1918.

The following is the sixth List of Contributions from Companies and Units of the Corps to the Prisoners of War Fund from September 23 until November 14.

The total received and expended this year has been over £21,000, and the Ladies' Committee desire to thank and congratulate the whole Corps on the magnificent response to their appeal.

Consequent on the conclusion of the Armistice we have been notified by the Central Prisoners of War Committee, of which we are a Branch, that they have been instructed by the War Office that it is impossible to continue the packing and dispatch of parcels addressed to individual prisoners of war, and the majority of Regimental Care Committees are being closed down.

The Central Committee has, however, specially requested our Committee to assist them in packing unaddressed parcels of food which they will dispatch under instructions from the War Office, to be contributed to a general stock so long as may be necessary.

The Ladies' Committee has accepted this invitation, and as we have more than 1,100 men of the Corps still prisoners in Germany, has undertaken to pack 1,000 parcels a week.

Under this arrangement we shall, of course, be acting only as a Branch of the Central Committee, and our financial transactions will be conducted direct with that Committee as from November 12.

The Ladies' Committee desire to place on record that the R.A.M.C. Prisoners of War Fund has been entirely self-supporting from its inception in November, 1914, when it was started as the R.A.M.C. Comforts Fund, and that if we take credit for stores now in hand and the subscriptions that are still being received we shall be able to claim that the Fund practically terminated its existence as a separate organization as from November 12, 1918, without ever having received any assistance from any source beyond our own Corps, officers and men and friends interested in the Royal Army Medical Corps.

It is hoped that a statement of accounts may be published shortly, but as donations from officers and units abroad will probably continue to come in for some time there may be a little delay.

E. M. Wilson,
Hon. Treasurer, R.A.M.C. Prisoners of War Fund.

SIXTH LIST.

List of Companies and Units at Home and Abroad Contributions to Prisoners of War Fund in 1918.

	£	s.	d.
September 25—			
No. 6 Company Detachment, R.A.M.C., Hazley Down	0	10	0
St. John Ambulance Brigade Hospital	3	11	0
2/3rd London Field Ambulance	19	3	5
Detachment, No. 8 Company, Clipstone Camp, Notts	10	0	0
51st Field Ambulance	18	6	8
R.A.M.C. School of Instruction Gymkhana	1,047	6	4
R.A.M.C. School of Instruction Gymkhana	1	12	0
September 30—			
109th Field Ambulance (Ulster)	26	16	5
188th Field Ambulance Officers, N.C.O.s and men	10	10	0
1st Birmingham War Hospital	30	0	0
2nd Wessex P.W.F. (4th donation)	50	0	0
R.A.M.C., 6th Company, Detachment, Guernsey	4	8	0
October 2—			
R.A.M C. Depot, Regimental Institutes	500	0	0

	£	s.	d.
Detachment, Catterick, No. 8 Company, R.A.M.C.	£0	17	0
1st Western General Hospital, Liverpool	17	7	3
3rd Western General Hospital, Cavalry Barracks Section .	3	0	0
Military Hospital, Fargo ..	25	0	0
302nd Field Ambulance ..	5	0	0
October 4—			
2nd Wessex P.O.W.F. (5th donation)	50	0	0
43rd General Hospital	5	0	0
Military Isolation Hospital, Aldershot	10	0	0
October 9—			
318th Field Ambulance	5	0	0
4th Training Battalion, Blackpool (September donation) ..	5	0	0
R.A.M.C. Magazine, Blackpool	100	0	0
7th Training Battalion, Blackpool (September donation) ..	4	0	7
35th Company, R.A.M.C. ..	20	0	0
Military Hospital, Frencham Hill, Farnham	5	0	0
R.A.M.C. 25th Company, Bermuda (further contribution)	1	5	0
October 12—			
Col. R. R. Sleman	1	1	0
Mrs. Sleman	1	1	0
1st City of London Field Ambulance	10	10	0
Central Military Hospital, Cork, per Mrs. F. Bruce	8	6	6
War Hospital, Sunderland—Medical, Nursing and other Staff	21	0	0
Northamptonshire War Hospital, all ranks	7	0	0
2nd Wessex P.O.W. Fund (6th donation)	50	0	0
No. 6th Company, Gosport, Detachment	0	17	9
October 16—			
No. 2 British General Hospital, Mesopotamia	20	13	1
Embarkation Staff, Southampton, R.A.M.C. Sports.. ..	50	0	0
No. 20 Ambulance Train ..	2	5	0
3rd Casualty Clearing Station..	5	5	0
60th General Hospital, Salonica	5	0	0
No. 9 Company, Colchester (additional)	22	1	0
333rd East Anglian Field Ambulance	10	0	0
Military Hospital, Warlingham, 12th Company	4	0	0
1/3rd East Lancashire Field Ambulance, Officers, N.C.O.s and Men	16	12	1
39th Casualty Clearing Station, Italy, Harvest Festival ..	10	0	0
October 18—			
18th Company, Rochester Row	50	0	0
2nd Wessex P.O.W. Fund (7th donation)	50	0	0
6th Training Battalion, Blackpool	9	3	11
1st Western General, Liverpool (September contribution) ..	8	0	4
October 21—			
5th Cavalry Field Ambulance..	£16	0	0
Detachment, R.A.M.C., Military Hospital, Newark	6	7	6
Detachment, 20th Company, Sutton, Coldfield	1	0	0
Detachment, R.A.M.C., 6th Company, Weymouth ..	5	0	0
Detachment, R.A.M.C., 6th Company, Hazley Down (further contribution)	0	12	0
3rd Training Battalion, Blackpool	5	0	0
October 26—			
1st Southern General Hospital (T.F.)	25	0	0
44th Casualty Clearing Station..	5	18	11
21st Casualty Clearing Station..	10	0	0
Ambulance Transports "Essequibo," "Grantully Castle," "St. Patrick," and "Western Australia"	26	11	0
October 28—			
Masonic Tombola and Military Sports, per Glasgow Star Lodge No. 219..	250	0	0
2nd Western General Hospital (T.F.), Manchester	33	3	3
341st Field Ambulance	4	15	0
Military Hospital, Weymouth, (collection at lecture).. ..	2	0	0
October 31—			
6th Training Battalion, Blackpool	100	0	0
2/2nd North Midland Field Ambulance (monthly donation)	7	6	0
Serjeants' Mess R.A.M.C. Depot, Blackpool	100	0	0
Command Depot, Alnwick, and Detachment	15	4	0
November 7—			
Officers R.A.M.C. Command Depot, Ripon	11	0	0
Lord Mayor of Liverpool's Shilling Fund (second donation)..	100	0	0
333rd Field Ambulance (second donation)	4	0	0
1/3rd South Midland Field Ambulance	20	0	0
R.A.M.C. Detachment, Alnwick (additional)	0	10	6
Ambulance Transport "Aberdonian" (further donation) ..	5	13	6
2nd Wessex P.O.W. Fund (eighth donation)	50	0	0
19th Company, Chester (contribution for October)	15	0	0
48th Casualty Clearing Station..	20	0	0
8th Training Battalion, Blackpool (monthly donation) ..	5	0	0
3rd London General Hospital, Wandsworth, Officers ..	13	0	0
R.A.M.C. Detachment, Hilsea	5	0	0
November 13—			
Detachment R.A.M.C., Guernsey (further donation)	3	0	0
32nd Company R.A.M.C., Singapore, Officers and men ..	105	0	0

	£	s.	d.
Military Hospital, Fargo (further donation, Officers)	£3	0	0
4th London Field Ambulance (N.C.O.s and men)	4	0	0
No. 8 Company, R.A.M.C., Grantham Detachment ..	10	0	0
5th Southern General Hospital, Portsmouth	6	15	6
27th Company, Hong Kong ..	6	0	0
November 14—			
4th Training Battalion, Blackpool (donation for November)	£5	0	0
4th Training Battalion, Blackpool (concert party)	2	1	2
51st Casualty Clearing Station (Officers)	2	0	0
1/2nd Highland Field Ambulance .. .. (1,000 frs.)	38	6	1
44th Casualty Clearing Station (250·50 frs.)	9	12	8

EXCHANGES, &c.

The charge for inserting Notices respecting Exchanges in the Royal Army Medical Corps is 5/- for not more than five lines, which should be forwarded by Cheque or P.O.O., with the notice, to Messrs. G. STREET and CO., Ltd., 8, Serle Street, London, W.C., not later than the 22nd of the month.

A free issue of twenty-five reprints will be made to contributors of Original Communications, and of twenty-five excerpts of Lectures, Travels and Proceedings of the United Services Medical Society.

Any demand for reprints, additional to the above, or for excerpts, must be forwarded at the time of submission of the article for publication, and will be charged for at the following rates, and additional copies at proportionate rates:—

Number of Reprints	Number of Pages	Cost of Reprints	Cost of Excerpts*	Extra for Covers for Reprints: As Journal, Printed on Front	As Journal, Plain, Unprinted	Cheaper Paper, Printed on Front	Cheaper Paper, Plain, Unprinted
		£ s. d.	£ s. d.	s. d.	s. d.	s. d.	s. d.
12	4	0 2 9	0 1 2	4 3	1 1	3 10	0 9
	8	0 5 0	0 2 3				
	16	0 8 3	0 3 11				
25	4	0 3 4	0 1 5	4 10	1 6	4 4	0 11
	8	0 6 0	0 2 9				
	16	0 10 6	0 5 0				
50	4	0 4 6	0 1 10	6 0	2 1	4 10	1 2
	8	0 7 6	0 3 6				
	16	0 13 3	0 5 10				
100	4	0 6 0	0 3 1	7 10	3 11	6 7	2 5
	8	0 10 0	0 4 10				
	16	0 18 6	0 7 6				
200	4	0 9 6	0 4 5	10 10	7 6	9 0	4 10
	8	0 15 0	0 6 7				
	16	1 6 0	0 9 8				

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Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are

inserted free of charge to subscribers and members of the Corps. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS," 324, Adastral House, Victoria Embankment, E.C. 4.

The following publications have been received:—

British: The Journal of State Medicine, Tropical Diseases Bulletin, The Indian Medical Gazette, Journal of the United Service Institution of India, The Medical Press, The Medical Review, The Journal of Tropical Medicine and Hygiene, The Army Service Corps Journal, Bulletin of the Canadian Army Medical Corps, The Medical Journal of Australia, The Royal Engineers Journal, Journal of the Royal Naval Medical Service, Guy's Hospital Gazette, The Hospital, The Practitioner, Seale Hayne Neurological Studies, Report of Port of Sydney, Proceedings of the Royal Society of Medicine.

Foreign: United States Public Health Service, War Medicine, Tidskrift I Militär Hälsovard, Bulletin de l'Institut Pasteur, Giornale di Medicina Militare, Archives Médicales Belges, Archives de Médicine et Pharmacie Navales, The Journal of Infectious Diseases, Journal of Agricultural Research, Arquivos do Institute Bacteriologico, Camara Pestana, United States Department of Agriculture, Office International d'Hygiene Publique, Norsk Tidskrift for Militaermedicin, Bulletin of the Johns Hopkins Hospital, Archives de Medicine et de Pharmacie Militaires, Surgery, Gynæcology and Obstetrics.

MANAGER'S NOTICES.

The JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is published monthly, six months constituting one volume, a volume commencing on 1st July and 1st January of each year.

The Annual Subscription is £1 (which includes postage), and should commence either on 1st July or 1st January; but if a subscriber wishes to commence at any other month he may do so by paying for the odd months between 1st July and 1st January at the rate of 1s. 8d. (one shilling and eightpence) per copy. (All subscriptions are payable in advance.)

Single copies can be obtained at the rate of 2s. per copy.

The Corps News is also issued separately from the Journal, and can be subscribed for at the rate of 2s. (two shillings) per annum, including postage. Subscriptions should commence from 1st July each year; but if intending subscribers wish to commence from any other month, they may do so by paying for the odd months at the rate of 2d. per copy. (All subscriptions are payable in advance.)

Officers of the Royal Army Medical Corps possessing Diplomas in Public Health, etc., are kindly requested to register their special qualifications at the War Office. Letters of complaint are frequently received from officers stating that their special qualifications have not been shown in the Distribution List which is published as a supplement to the Journal in April and October of each year. As, however, the particulars of this list are supplied from official sources, officers are reminded that unless the possession of Diplomas, etc., has been registered at the War Office, no entry of such qualifications can be recorded in the Distribution List.

Letters notifying change of address should be sent to the Hon. Manager, "Journal of the Royal Army Medical Corps," 25, Adastral House, Victoria Embankment, E.C. 4, and must reach there not later than the 20th of each month for the alteration to be made for the following month's issue.

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THE HON. MANAGER,
"JOURNAL OF THE ROYAL ARMY MEDICAL CORPS,"
25, ADASTRAL HOUSE, VICTORIA EMBANKMENT, E.C.4.

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS.

Corps News.

DECEMBER, 1918.

EXTRACTS FROM THE "LONDON GAZETTE."

War Office,
November 9, 1918.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for Distinguished Services rendered during the course of the campaign:—

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

DECORATIONS CONFERRED BY HIS HIGHNESS THE SULTAN OF EGYPT.

Order of the Nile, Second Class.

Surg.-Gen. Sir James Maher, K.C.M.G., C.B.

Order of the Nile, Third Class.

Lieut.-Col. Hugh Wright Thomson, M.B., Royal Army Medical Corps.

DECORATIONS CONFERRED BY THE PRESIDENT OF THE PORTUGUESE REPUBLIC.

Red Cross Medal, Second Class.

Major (Temp. Lieut.-Col.) Horace George Pinches, Royal Army Medical Corps.

War Office,
November 13, 1918.

His Majesty the King has been graciously pleased to approve of the award of the Military Medal for Bravery in the Field to the undermentioned Non-commissioned Officers and Men:—

ROYAL ARMY MEDICAL CORPS.

352596 Serjt. W. F. Crow (Manchester).
35521 Serjt. F. Dodd (South Yardley).
388466 Cpl. C. W. R. Warren (Southwick, Sunderland).
35801 Pte. D. Anderson (Lochgelly).
43318 Pte. H. Branch (Mountain Ash).
339208 Pte. G. Breithaupt (Liverpool).
21119 Pte. E. Butterwick (Hull).
35764 Pte. W. Clapp (Tiverton).
401346 Pte. J. Daniels (Leeds).
47852 Pte. J. W. Dever (Oldham).
9012 Pte. R. H. Durbin (Oakenshaw, Durham).
41896 Pte. (Acting Serjt.) H. B. Hollyer (Droitwich).
43131 Pte. J. Hughes (Oldham).
36370 Pte. M. Ireland (Kelty).
6834 Pte. J. G. Jones (Rhyl).
401433 Pte. G. Ormsby (Leeds).
68570 Pte. W. C. Robinson (Douglas, Isle of Man).
68213 Pte. T. Scanlon (Wigan).
75561 Pte. S. Simpson (Leek, Staffs).
29327 Pte. A. L. Truslove (Smethwick).
87706 Pte. F. H. Warden (Leicester).

War Office,
November 15, 1918.

His Majesty the King has been graciously pleased to approve of the award of the Distinguished Conduct Medal to the undermentioned Non-commissioned Officers and Man for Gallantry and Distinguished Service in the Field :—

439013 Serjt. E. V. Cann, M.M., Royal Army Medical Corps (Bristol).

For conspicuous gallantry and devotion to duty during a raid. He was in charge of a relay post in the front line which was blown in, burying a chaplain. He immediately went to his rescue and dragged him into a dug-out, finally carrying him under shell fire to a relay post in the rear. He behaved splendidly.

48124 Serjt. T. G. Hopkins, M.M., Royal Army Medical Corps (Treorchy).

Heavy shelling had caused severe casualties among artillery men and transport on a road. In spite of the difficulty and great danger, he went to the aid of the wounded, extricated them from a tangle of kicking animals, and carried them to the comparative safety of shell holes. He carried four wounded men one after another on his back. On a later date he brought back many wounded from an area heavily swept by machine-gun fire. He was twice blown up by shells, but managed to reach the A.D.S. and notify where the wounded were collected before he collapsed. His gallantry and self-sacrificing devotion to duty were peculiarly admirable.

46942 Pte. M. O'Hara, Royal Army Medical Corps (Heywood).

For conspicuous gallantry and devotion to duty. When he and three other bearers were bringing a wounded man to the advanced dressing station a shell burst and wounded two of the bearers and killed the third. He at once carried the wounded men into shelter and then went under heavy fire and collected three more bearers and brought all wounded back to the advanced dressing station. He behaved splendidly.

War Office,
November 29, 1918.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for Distinguished Services rendered during the course of the campaign :—

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

Decorations conferred by the President of the French Republic.

Légion d'Honneur.

Croix de Guerre.

Major (Temp. Lieut.-Col.) Hugh Allan Davidson, D.S.O., M.B., Royal Army Medical Corps.

Major-Gen. James Barnett Wilson, C.B., C.M.G., M.D., Army Medical Service.

439130 Pte. Hugh Douglas Alexander Dun, 1/3rd (South Midland) Field Ambulance, Royal Army Medical Corps (Territorial Force) (Bristol).

439403 Pte. Thomas Victor Harris, 1/3rd (South Midland) Field Ambulance, Royal Army Medical Corps (Territorial Force) (Portishead).

M/288402 Pte. David McIlvenny, M.M., Army Service Corps, attached 1/3rd (South Midland) Field Ambulance, Royal Army Medical Corps (Territorial Force) (Belfast).

43035 Pte. (Acting Serjt.) David John James, M.M., 75th Field Ambulance, Royal Army Medical Corps (Tylorstown, Rhondda).

Correction.

With reference to the award of the Croix de Guerre to Captain Gideon Johannes Joubert, South African Medical Corps, published in the 5th Supplement to the *London Gazette* of August 20, 1918, the letters "M.C." after his name should be amended to read "M.B."

Decorations and Medals conferred by His Majesty the King of Italy.

Order of the Crown of Italy.

Cavalier.

Temp. Capt. John Harold Peek, M.D., Royal Army Medical Corps.

Officer.

Lieut.-Col. (Acting Col.) Henry Hewetson, D.S.O., Royal Army Medical Corps.

Bronze Medal for Military Valour.

Capt. (Acting Major) Albert Edward Peel McConnell, M.C., Royal Army Medical Corps (Territorial Force).

Croce di Guerra.

Temp. Capt. Andrew Findlay Readdie, Royal Army Medical Corps.
435305 Pte. Albert John Brewer, 1/1st South Midland Field Ambulance, Royal Army Medical Corps (Territorial Force) (Alvechurch, near Birmingham).
439180 Lance-Cpl. Harry Ernest Pitman, 1/3rd South Midland Field Ambulance, Royal Army Medical Corps (Territorial Force), (Bristol).
2029 Serjt. Frank Robinson, M.M., 23rd Field Ambulance, Royal Army Medical Corps (Strood, Kent).

DECORATIONS CONFERRED BY HIS MAJESTY THE KING OF THE BELGIANS.

Ordre de la Couronne.

Officier.

Capt. Eric Leigh Fyffe, M.B., Royal Army Medical Corps.

Ordre de Leopold II.

Chevalier.

70609 Pte. Ernest Bell, Royal Army Medical Corps (Gateshead).
79983 Pte. William Birnie, Royal Army Medical Corps (Rathen).
82002 Pte. William John Green, Royal Army Medical Corps (Bedford).
1385 Cpl. Charles James Joseph, South African Medical Corps.
1123 Serjt. Edward Frederick Martin, Kaschula, South African Medical Corps.
988 Serjt. Edmund Bloomfield Kekewich, South African Medical Corps.
33153 Serjt. Richard E. Lake, Royal Army Medical Corps (Nelson).
92309 Pte. (Acting Cpl.) Archibald McArthur, Royal Army Medical Corps (Partick, Glasgow).
1398 Serjt. Donald MacFarquhar, South African Medical Corps.
53946 Pte. Joseph A. Hooney, Royal Army Medical Corps (Cork).
2245 Pte. Frederick George Odendal, South African Medical Corps.
18432 Qmr.-Serjt. (Temp. Serjt.-Major) George Frederick Pearce, Royal Army Medical Corps ("E" Leeds).
49058 Pte. Hamilton Relly Taffs, Royal Army Medical Corps (Wandsworth Common, S.W.).
295 Staff-Serjt. Charles Richard Tee, South African Medical Corps.

War Office,
December 4, 1918.

The Secretary of Statefor War has received the following Dispatch from General the Earl of Cavan, K.P., K.C.B., M.V.O., Commanding-in-Chief British Forces in Italy.

General Headquarters,
British Forces in Italy,
November 15, 1918.

38. The fresh influenza epidemic, which broke out shortly before the commencement of the operations, threw a heavy and additional strain on the medical service. Despite this the evacuation and care of both sick and wounded was rapidly and satisfactorily carried out. All the arrangements were most ably organized by my Director of Medical Service, Major-General F. R. Newland, C.B., C.M.G.

ARMY MEDICAL SERVICE.

Col. James Meek, C.B., M.D., is placed on retired pay, dated November 20, 1918.
Col. Henry Mackenzie Adamson, C.B., M.B., is placed on retired pay, dated November 26, 1918.

ROYAL ARMY MEDICAL CORPS.

Capt. Wilfred W. Treves, M.B., F.R.C.S., to be acting Major, dated January 4, 1918.
Major William Davis to be acting Lieutenant-Colonel whilst in command of a Medical Unit, dated August 31, 1918.
Capt. (Acting Major) Alan G. Wells, D.S.O., to draw the pay and allowances of his acting rank whilst specially employed, dated September 10, 1918.
Lieut.-Col. Harold P. W. Barrow, C.M.G., D.S.O., relinquishes the temporary rank of Colonel on reposting, dated September 18, 1918.
Major Rochford N. Hunt, D.S.O., M.B., relinquishes the temporary rank of Lieutenant-Colonel on reposting, dated October 14, 1918.
Capt. Alexander D. Fraser, D.S.O., M.C., M.B., relinquishes the acting rank of Lieutenant Colonel and reverts to the acting rank of Major (with pay and allowances of his substantive rank), dated October 15, 1918.

The undermentioned to be Captains, but not to reckon for pay or allowances prior to December 1, 1918, with precedence as stated:—
Captains, from Special Reserves:—
Dated February 5, 1918.—Francis Dighton Annesley, M.C., next below E. Davies.
Dated February 6, 1918.—William Tyrrell, D.S.O., M.C., M.B., next below R. E. Barnsley.

Dated February 8, 1918.—Joseph Hugh Ward, D.S.O., M.C., M.B., next below St. J. D. Buxton.

Dated February 14, 1918.—Robert Chalmers Aitchison, M.B., next below G. D. Robertson.

Dated March 15, 1918.—William Bird, M.B., next below H. H. Mulholland.

Dated March 19, 1918.—William Ernest Tyndall, M.C., M.B., next below J. A. W. Ebden.

Dated March 30, 1918.—James Vallance, M.B., next below A. N. Minns; Robert Godfrey Martyn, M.B., next below C. de W. Gibb.

Captains, from Territorial Force:—

Dated April 12, 1918.—James Wilson Burton, M.B., next below C. K. G. Dick.

Dated June 1, 1918.—Manfred Morris, M.B., next below D. N. Macleod.

Dated June 15, 1918.—Basil Hugh Campbell Lea-Wilson, next below W. E. Adam.

Temporary Captains:—

Dated July 10, 1918.—Frederick Harris, M.C., M.B., next below R. P. Cormack.

Dated November 7, 1918.—Gerald Sholto Douglas, next below A. J. Hickey.

The undermentioned to be Lieutenants, and to be granted the temporary rank of Captain, but not to reckon for pay or allowances prior to December 1, 1918:—

Dated July 21, 1915.—Capt. James Wilfred George Hewat Riddel, M.C., from Territorial Force, with precedence next below F. R. S. Shaw.

Dated February 29, 1916.—Temp. Capt. Philip Hewer Wells, M.C., with precedence next below W. L. A. Harrison.

Dated July 1, 1916.—Capt. Charles Owen James Young, M.C., M.B., from Special Reserve, with precedence next below G. T. Garraway.

The undermentioned relinquish the acting rank of Major on reposting:—

Dated September 29, 1918.—Capt. Charles J. O'Reilly, M.C., M.D.

The undermentioned to be acting Majors:—

Dated September 28, 1918.—Capt. William F. Christie, M.B.

Dated October 1, 1918.—Capt. James Y. Moore.

OBITUARY.

LIEUT.-COL. J. T. McENTIRE, R.A.M.C.

The Corps has lost a good officer in the late Major (Acting Lieut.-Col.) James T. McEntire, who succumbed to heart failure following influenza and pneumonia, at Salonika, on October 29, 1918.

He was the eldest son of the late Alexander Knox McEntire, J.P., B.L., Official Assignee in Ireland, of Merrion Square, Dublin, and of Mrs. McEntire, Pembroke Park, Dublin, and was educated at St. Andrew's College, in the same city. At Trinity College the deceased officer obtained the degrees of B.A. and M.B. in 1902, and the D.P.H. in 1911. In the year following his graduation he joined the Royal Army Medical Corps, and served in South Africa for five years, and on the West Coast for two years. He went to France from Ireland in 1914 with the original British Expeditionary Force, receiving the "Mons" Star; and in recognition of his good work in the early fighting, in which he was often in positions of great danger, the French Government conferred the Legion of Honour upon him after the battle at Le Cateau. He was also mentioned in dispatches on three occasions.

In June, 1917, after a short rest at home, he was sent to Salonika in charge of the Surgical Division of a General Hospital, and early this year he was given the command of a Stationary Hospital, with the acting rank of Lieutenant-Colonel.

He married Mary, daughter of James Little, Esq., of Sark Tower, Dumfriesshire, and has left one young daughter.

Lieut.-Col. McEntire's kind and cheerful disposition made him very popular with all ranks, and he served with marked enthusiasm and keenness throughout the war. The Corps has lost a very gallant officer, and the sympathy of his many friends goes out to his widow and child in their grievous loss.

BIRTHS.

MITCHELL.—On November 16, at Leintwardine, Herefordshire, the wife of Major Wright Mitchell, Royal Army Medical Corps, of a daughter.

GOODWIN.—On December 1, 1918, at 7, Mount Park Crescent, Ealing, the wife of Lieut.-Col. W. R. P. Goodwin, D.S.O., Royal Army Medical Corps, a son.

DEATH.

HODGSON. — On November 5, at Salonika, of pneumonia following influenza, Lieut.-Col. John Edward Hodgson, Royal Army Medical Corps, dearly loved husband of Winifred Hodgson, 4, South Mount Terrace, York, aged 44.

EXCHANGES, &c.

The charge for inserting Notices respecting Exchanges in the Royal Army Medical Corps is 5/- for not more than five lines, which should be forwarded by Cheque or P.O.O., with the notice, to Messrs. G. STREET and CO., Ltd., 8, Serle Street, London, W.C., not later than the 22nd of the month.

WANTED to complete a set: Volume 27, Part 5, Journal of the R.A.M.C. G. E. STECHERT & Co., 2, Star Yard, Carey Street, W.C. 2.

A free issue of twenty-five reprints will be made to contributors of Original Communications, and of twenty-five excerpts of Lectures, Travels and Proceedings of the United Services Medical Society.

Any demand for reprints, additional to the above, or for excerpts, must be forwarded at the time of submission of the article for publication, and will be charged for at the following rates, and additional copies at proportionate rates:—

Number of Reprints	Number of Pages	Cost of Reprints	Cost of EXCERPTS*	Extra for Covers for Reprints: As Journal, Printed on Front	As Journal, Plain, Unprinted	Cheaper Paper, Printed on Front	Cheaper Paper, Plain, Unprinted
		£ s. d.	£ s. d.	s. d.	s. d.	s. d.	s. d.
	4	0 2 9	0 1 2				
12	8	0 5 0	0 2 3	4 3	1 1	3 10	0 9
	16	0 8 3	0 3 11				
	4	0 3 4	0 1 5				
25	8	0 6 0	0 2 9	4 10	1 6	4 4	0 11
	16	0 10 6	0 5 0				
	4	0 4 6	0 1 10				
50	8	0 7 6	0 3 6	6 0	2 1	4 10	1 2
	16	0 13 3	0 5 10				
	4	0 6 0	0 3 1				
100	8	0 10 0	0 4 10	7 10	3 11	6 7	2 5
	16	0 18 6	0 7 6				
	4	0 9 6	0 4 5				
200	8	0 15 0	0 6 7	10 10	7 6	9 0	4 10
	16	1 6 0	0 9 8				

* These are not arranged as Reprints, but appear precisely as in the Journal with any other matter that may happen to appear on the first and last pages of the particular excerpt ordered.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are inserted free of charge to subscribers and members of the Corps. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS," 324, Adastral House, Victoria Embankment, E.C. 4.

The following publications have been received:—

British: Guy's Hospital Gazette, St. Bartholomew's Hospital Journal, The Medical Journal of Australia, Edinburgh Medical Journal, Guy's Hospital Report, St. Thomas's Hospital Report, The Journal of Tropical Medicine and Hygiene, The Hospital, The Medical Press, Tropical Diseases Bulletin, The Medical Journal of South Africa, The Medical Review, Reveille, The Royal Engineers' Journal, Journal of the Royal United Service Institution, Journal of the Department of Public Health, Hospital and Charitable Aid, Public Health, St. Bartholomew's Hospital Report, The Indian Medical Gazette, Bulletin of the Canadian Army Medical Corps, The British Journal of Surgery, The Practitioner, The Army Service Corps Journal.

Foreign: Archives Médicales Belges, United States Public Health Service, Bulletin de la Société de Pathologie Exotique, Bulletin de l'Institut Pasteur, Surgery, Gynæcology and Obstetrics, Abstracts of Bacteriology, The Journal of Infectious Diseases, Office International d'Hygiène Publique.

MANAGER'S NOTICES.

The JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is published monthly, six months constituting one volume, a volume commencing on 1st July and 1st January of each year.

The Annual Subscription is £1 (which includes postage), and should commence either on 1st July or 1st January; but if a subscriber wishes to commence at any other month he may do so by paying for the odd months between 1st July and 1st January at the rate of 1s. 8d. (one shilling and eightpence) per copy. (All subscriptions are payable in advance.)

Single copies can be obtained at the rate of 2s. per copy.

The Corps News is also issued separately from the Journal, and can be subscribed for at the rate of 2s. (two shillings) per annum, including postage. Subscriptions should commence from 1st July each year; but if intending subscribers wish to commence from any other month, they may do so by paying for the odd months at the rate of 2d. per copy. (All subscriptions are payable in advance.)

Officers of the Royal Army Medical Corps possessing Diplomas in Public Health, etc., are kindly requested to register their special qualifications at the War Office. Letters of complaint are frequently received from officers stating that their special qualifications have not been shown in the Distribution List which is published as a supplement to the Journal in April and October of each year. As, however, the particulars of this list are supplied from official sources, officers are reminded that unless the possession of Diplomas, etc., has been registered at the War Office, no entry of such qualifications can be recorded in the Distribution List.

Letters notifying change of address should be sent to the Hon. Manager, "Journal of the Royal Army Medical Corps." 25, Adastral House, Victoria Embankment, E.C. 4, and must reach there not later than the 20th of each month for the alteration to be made for the following month's issue.

It is requested that all Cheques or Postal Orders for Subscriptions to the Journal, Corps News, Reprints, etc., be crossed "Holt & Co.," and made payable to the "Hon. Manager, Journal R.A.M.C.," and not to any individual personally.

All communications for the Hon. Manager regarding subscriptions, etc., should be addressed to

THE HON. MANAGER,
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